A REVISION OF THE AMERICAN SPECIES OF EUPHORBIA OF THE SECTION TITHYMALUS OCCURRING NORTH OF MEXICO.

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Since Boissier's monograph of the genus Euphorbia was published in De Candolle's Prodomus, in 1862, no general work on the North American species of the above section has appeared, though a number of new species have been distinguished, and most of them published in isolated works. Before the time of Boissier's monograph, Dr. George Engelmann had done a large amount of work on the genus in North America, and published several papers, and had at that time a monograph in preparation. Many notes and specimens sent by Engelmann were used by Boissier in his work. Afterward Dr. Engelmann continued his studies in Euphorbia until his death, being the only American botanist well acquainted with this group of plants. His synopsis of the Euphorbias of the Mexican boundary gives a complete account of the species in the Southwest. In later years Dr. C. F. Millspaugh has done considerable work upon the genus in this country; but aside from the works of Engelmann and Boissier, very little has been published upon the section under consideration.

Some two and a half years ago this revision was begun at the Missouri Botanical Garden, and has been carried on there with the aid of the Garden herbarium and library, which contain the rich and invaluable herbarium, library, and notes of Dr. Engelmann. Besides these I have used the material of this section from the herbaria of Harvard University, Columbia University, the United States National Museum, the California Academy of Science, Dr. C. F. Millspaugh, the Kansas State Agricultural College,

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Vermont State University, Ohio University, Iowa Agricultural College, and Florida Agricultural College; and while in Philadelphia for a few hours in 1898, I made a hasty examination of the herbarium of the Philadelphia Academy of Sciences. My thanks are due to those who have kindly permitted me to examine the collections in their charge and to many others who have sent smaller collections or specimens from various parts of the country; and especially to Dr. Wm. Trelease, at whose suggestion the work was taken up, for every possible facility and kindness in carrying on the work at the Garden and securing for my examination the collections from the larger herbaria of the country.

Aside from recording what has come to light in a study of the material accumulated in herbaria from the many collections of the thirty-seven years since the last revision, it is hoped that the present monograph may at least have some value in collecting the isolated descriptions, and putting in more accessible form our knowledge regarding this group of plants; and that it may be some aid to future students of Euphorbia.

In general I have followed the system of classification used by Boissier, and, with little modification, by the principal systematists since his time. The subsections are left practically as he defines them, with the exception of *Ipecacuanhae* which is modified by the removal of *E. Ipecacuanha* L., its relative *E. gracilis* Ell. and *E. trichotoma* HBK. The first two must be excluded from *Tithymalus* because of the presence of distinct though minute stipules, and very narrow but usually evident glandular appendages. *E. trichotoma* is placed in the subsection *Esulae* because of the carunculate seeds. Some slight rearrangement of the species in the subsections has been made, which I believe will better indicate the natural relationships.

The section *Tithymalus* comprises the greater part of the known species of Euphorbia, containing nearly 400 of the 700 or more described. Comparatively few occur in

America, where the sections *Anisophyllum* and *Adenopetalum* predominate. The greater number of our species are in the southwestern part of the country and are largely xerophytic in habitat. Of the species here included eight are introduced from Europe.

The plants have one to many herbaceous or occasionally suffruticose stems from annual, biennial, or perennial roots or sometimes rootstocks. They usually branch at the crown and in the axils of the scattered stem leaves (decussate in one species). The main stem is terminated by an involucre which is usually abortive or with the pistillate flower abortive. This is surrounded by three to many branches of the cymose umbel (rays). In the descriptions the length of these is given to the first floral leaves. The rays are subtended by leaves usually somewhat different in form from those of the stem (umbel leaves). The rays branch dichotomously an indefinite number of times, the involucres being terminal in the forks, and they and the leaves becoming smaller and more imperfect toward the top. The leaves in the umbel (floral leaves) are opposite except in *E. trichotoma*, and wider in proportion to the length than those below, and tend to be bilaterally unequal. The involucres are usually turbinate or campanulate, and are composed of five modified leaves joined, with the upper ends (lobes) free. Between the lobes are the five or less nectariferous glands. In most cases one of the glands is absent or replaced by a sixth lobe, leaving a sinus in which the pedicel of the pistillate flower is declined. The glands and lobes next this sinus are often different in size and shape from the others. The lower involucres are longer peduncled and often have five or more glands when those above have normally four. In the center of the involucre is the single pistillate flower. The three styles are free or united below and more or less bifid above, and erect or spreading at different periods of their life history. They are terminated by the clavate or often almost capitate

stigmas. Opposite each lobe is a group of staminate flowers, indefinite in number and subtended by minute bracts which partake more or less of the characters of the lobes. The pendulous seeds are smooth or variously sculptured. The embryo is pendent and the cotyledons are ovate and often cordate. The measurements of seeds are exclusive of the caruncle. The caruncle, which is usually present, occupies an oblique ovate or triangular space about the funiculus. The raphe forms a line from this to the chalaza at the lower end where there is often a circular depression.

The small size of the flowers and the complicated structure of the inflorescence make the study of the genus somewhat difficult; and the great variability of the leaf and involucral characters has led some authors into error. The method of branching and the phyllotaxy offer much aid in classification, as also does the shape of the glands and lobes within certain limits. The seeds give the best specific characters, being very constant in shape and markings and usually in size, except in the perennial species of the subsection *Esulae*, where the seeds of several species differ but little.

A list of the specimens seen is given at the end of each description. Other important localities mentioned by other authors are given at the end of this.

I have intended to cite all the synonyms of species described, the most important American publications, and some of the better illustrations of such as have been figured. For the most part, the Madison rules for citation have been followed. The illustrations are cited after the other works, and preceded by a dash. Some of the more important general works are indicated at the end of the revision; for other literature the reader is referred to these, especially to the first three, where more complete bibliographies are given.

In the diagram of relationships, Table A, the length of

lines shows in some degree the probable distance of relationship; and as nearly as possible apparently related species of different groups have been approximated.

For morphological works see Warming, Er Koppen hos Vortemaelken en Blomst eller en Blomsterstand? Köbenhavn. 1871; and Eichler, A. W. Blüthendiagramme **2**: 386–392. 1878.

For anatomical works see Pax, F. Die Anatomie der Euphorbiaceen in ihrer Beziehung zum System derselben. Engler's Bot. Jahrb. **5**: 384–421. *pl. 6, 7.* 1884; and Pammel, L. H. On the Seed-coats of the Genus Euphorbia. Trans. Acad. Sci. St. Louis **5**: 343–368. *pl. 12–14.* 1891.

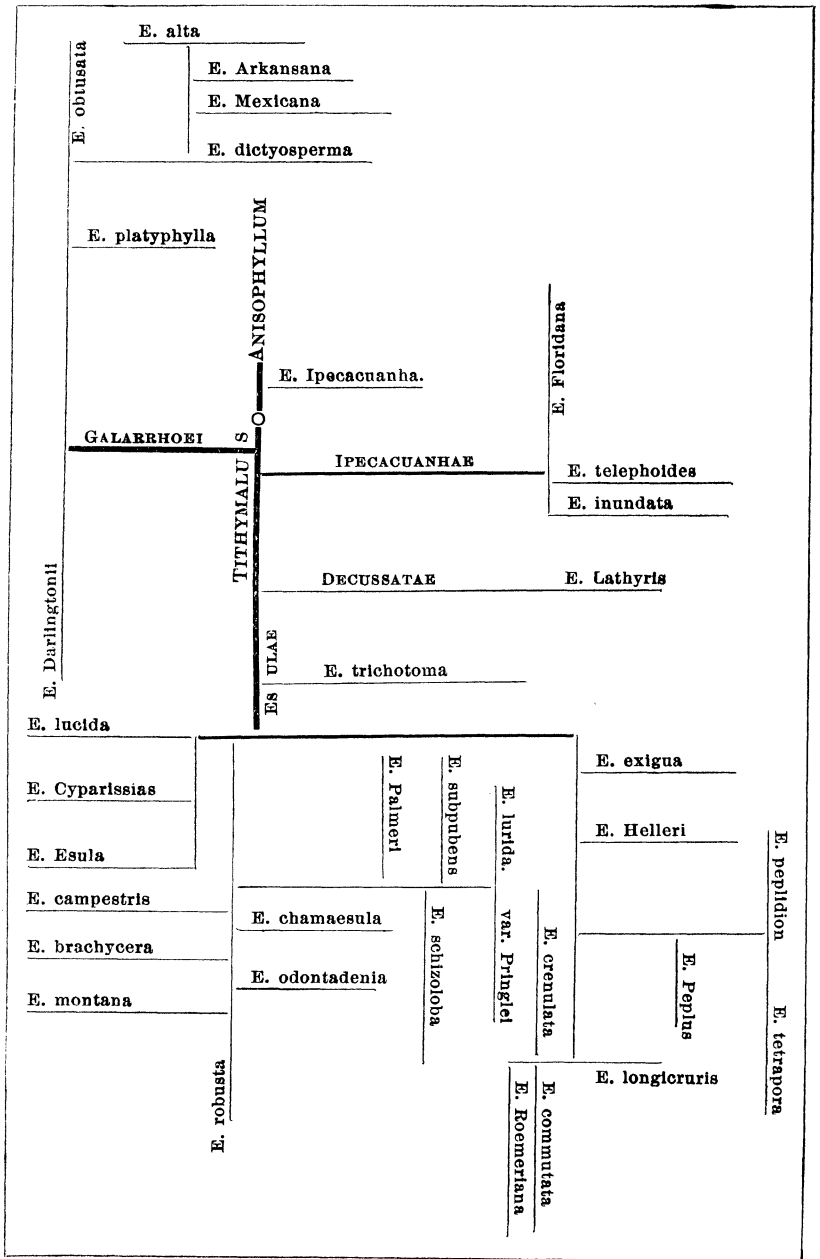
For works on distribution, etc., see Bentham, G. Notes on Euphorbiaceae. Journ. Linn. Soc. Bot. **17**: 185–267. 1880; and Kränzlin, Die Verbreitung der Arten der Gattung Euphorbia. Progr. 39. Berlinisches Gymnasium zum grauen Kloster. 1876.

For works on medicinal and economic properties see Dragendorf, G. Die Heilpflanzen 385–391. 1898; and Millspaugh, C. F. Medicinal Plants **2**: 147–150. 1892.

EUPHORBIA Linn. Sp. Plant. 450. 1753.

§ TITHYMALUS. The floral leaves opposite, the others usually alternate, exstipulate; inflorescence cymose umbellate; glands exappendiculate.

TABLE A.— DIAGRAM OF RELATIONSHIP.



ANALYTICAL KEY.

I. Glands of the involucre with a rotund and entire margin.

A. Leaves entire, seeds without a caruncle. *E. telephoides, E. inundata.*

B. Leaves serrulate, seeds carunculate.

a. Ovary and capsule smooth.

1. Seeds ovoid, pointed at apex, rays 5. *E. Helioscopia.*

2. Seeds globose lenticular, rays 3. *E. leiococca.*

b. Ovary and capsule verrucose.

1. Seeds smooth, rays 5 or more; perennial by a rootstock. *E. Darlingtonii.*

2. Seeds smooth (sometimes faintly reticulate in *E. obtusata*), rays 3 to 5; annual.

Pubescent, leaves acute, rays 3 to 5. *E. platyphylla.*

Smooth, leaves obtuse, rays 3. *E. obtusata.*

3. Seeds reticulate, rays 3; annual or some biennial or perennial by crown buds.

* Stems cymosely branched below the umbel, capsules short warted.

† Styles divided nearly to the base, leaves rotund or retuse at the apex. *E. dictyosperma.*

†† Styles not divided below the middle, leaves acute or only obtuse.

Most of the floral leaves longer than wide. *E. Arkansana Missouriensis.*

Floral leaves about as broad as long. *E. Arkansana.*

Many stemmed, floral leaves narrowly oblong. *E. Mexicana.*

** Racemosely branched, capsules long warted; high mountain plants. *E. alta.*

Margins of glands not rotund nor entire.

A. Stem leaves decussate. *E. Lathyris.*

B. Stem leaves alternate.

a. Most of the floral leaves alternate; trichotomously branched. *E. trichotoma.*

b. Floral leaves opposite, rays dichotomous.

1. Seeds not carunculate, involucres shorter than their peduncles, calyx 3-lobed.

* Peduncles 5 to 12 mm. long, floral leaves cordate, glands wrinkled. *E. Floridana.*

** Peduncles 1 to 3 cm. long, floral leaves rarely cordate, glands smooth.

Leaves of the stem lance-linear. *E. inundata.*

Leaves of stem oblanceolate to obovate. *E. telephoides.*

2. Seeds carunculate, calyx obscure, discoid or triangular, involucres usually longer than their peduncles.

* Seeds smooth. (See also *E. chamaesula* and related species when immature).

† Rays 3; annual. *E. Helleri.*

†† Many rayed; perennial.

Capsules verrucose, leaves linear; not over a foot high. *E. Cyparissias.*

Capsules slightly roughened or smooth, leaves lanceolate; over a foot high.

Stem leaves less than 1.5 cm. wide. *E. Esula.*

Stem leaves over 1.5 cm. wide. *E. lucida.*

** Seeds tuberculate; low annual with acute floral leaves. *E. exigua.*

*** Seeds with rows of pits, at least on the ventral side; annuals, usually with obtuse floral leaves.

† Capsule crested. *E. Peplus.*

†† Capsule smooth, or nearly so.

Two sulci on the inner face of the seed. *E. peplidion.*

Several pits on the inner face of the seed. *E. tetrapora.*

**** Seeds irregularly covered with pits or ridges.

† Thin leaved annuals.

‡ Seeds with small deep pits.

Floral leaves very unequal, longer than the internodes. *E. longicruris.*

Floral leaves nearly symmetrical, shorter than the internodes. *E. commutata.*

‡‡ Seeds with broad pits, and ridges between.

Floral leaves connate to the middle; in Texas. *E. Roemeriana.*

Floral leaves connate at the base or to the middle on one side; Pacific slope. *E. crenulata.*

†† Perennials.

‡ Horns of the glands longer than their body.

Seeds punctate pitted; central United States. *E. commutata.*

Seeds with broad shallow pits; Pacific slope. *E. crenulata.*

‡‡ Horns of the glands shorter than their body.

‖ Glands crenate and very short horned, lobes oblong.

¶ Stem leaves widest above the middle.

§ Stem leaves obtuse, floral leaves broader than long.

Glabrous. *E. Palmeri.*

Pubescent. *E. subpubens.*

§§ Stem leaves obtuse, floral leaves as long as broad. *E. lurida.*

§§§ Stem leaves acute. *E. lurida Pringlei.*

¶¶ Stem leaves widest at or below the middle. *E. schizoloba.*

||| Glands semilunate, the horns longer than the teeth, if any, between them, lobes triangular ovate.

¶ Seeds large, broadly truncate at the base, capsules 5 mm. long. *E. chamaesula.*

¶¶ Seeds and capsules smaller, seeds not prominently truncate.

§ Inflorescence compact, internodes not much longer than the floral leaves, stem leaves lance-linear; Mexican. *E. campestris.*

§§ Inflorescence open, internodes longer than the leaves, stem leaves ovate to oblong.

Low, robust; northern. *E. robusta.*

Slender; southern.

Stem leaves ovate to oblong. *E. montana.*

Stem leaves small, lanceolate. *E. odontadenia.*

Stem leaves oblong to linear. *E. brachycera.*

SYNOPSIS OF NORTH AMERICAN SPECIES.

A. *Decussatae.* Stem leaves decussate, entire; glands 4, bicornute, the horns spatulate; lobes parallel veined; stamens and bracts numerous; seeds carunculate.

E. LATHYRIS Linn. Sp. Plant. 457. 1753; Boiss. DC. Prod. **15**^{2}: 99. 1862; Wats. Bot. Calif. **2**: 76. 1880; Gray, Man. 406. 1848; Brit. & Brown, Ill. Flora **2**: 377. 1897; Greene, Man. Bay Region 80. 1894; Pursh, Flora **2**: 607. 1814. *E. decussata* Salisb. Prod. 389. 1796. (fide Index Kewensis). *Tithymalus Lathyris* Hill, Hort. Kew. 172(3). 1768; Kl. & Gar. Tricoc. 95. 1860. *Galarhoeus decussatus* S. F. Gray, Nat. Arr. Brit. Pl. **2**: 256. 1821. *G. Lathyris* Haw. Pl. Suc. 143. 1812. *E. spongiosa* Ledeb. ex Schrank in Syll. Ratisb. **1**: 214. 1824. (fide Index Kewensis). *Epurga Lathyris* Fourr. Ann. Soc. Linn. Lyon n. s. **17**: 150. 1869. (fide Index Kewensis). *Epurga pensylvanica* Gandoger, Fl. Eur. **20**: 70. 1890. *Euphorbion lathyrum* Saint Lager, Ann. Soc. Bot. Lyon **7**: 126. 1880.—Reichenb. Ic. Fl. Germ. *f. 4783;* Brit. & Brown, Ill. Flora *f. 2327;* Pammel, Seed-coats *pl. 12. f. 18d;* Millspaugh, Medic. Plants *pl. 150.*

Annual; stem single, erect, smooth, glaucous, 4 to 10

dm. high; rays 4, 3 to 9 cm. long, many times dichotomous, the alternate branches sometimes abortive; leaves sessile or very short petioled below the cordate or rotund base, linear lanceolate, or sometimes lanceolate, the lower obtuse, mucronate, the upper acute, glaucous, spreading, 8 to 20 mm. wide, 4 to 12 cm. long; umbel leaves nearly similar; floral leaves lance-ovate, subcordate, sometimes subpandurate, more or less parallel veined, acute or acuminate, 1 to 3 cm. wide, 2 to 6 cm. long; involucres 3 to 4 mm. long, pubescent under the glands; lobes ovate, fimbriate, erect and valvate between the glands; glands semilunar, the horns spatulate and usually recurved; sinus deep; sixth lobe small, or none; bracts small, the larger ones fimbriate, a few hairs at the apex; stamens 25 to 40, their pedicels pubescent with a few scattering hairs; styles 2 to 3 times as long as the ovary, 2 mm. long, short bifid above, the stigmatose ends flattened; capsule spherical, fleshy, wrinkled when dry, 8 to 10 mm. in diameter; sulci shallow, cocci obtuse; seeds ovoid, truncate, a broad shallow groove in front, wrinkled, dirty brown colored, with darker spots, 4 to 4.5 mm. long, 3 to 3.5 mm. wide, 3.5 mm. thick; hilum large, white; caruncle round, hat shaped, substipitate. — Introduced from Europe into various parts of the United States and many other parts of the world. It has been found in California, Texas and New Mexico (fide Coulter, Bot. West. Tex. 393.), and in many places along the mountains in the eastern United States where it may possibly be indigenous. — Plate 11.

Specimens examined from Pennsylvania (Parker, Harrisburg, 1865); Virginia (Britton and others, St. Clair's Creek, 1892, Luray, 1890; Small, St. Clair's Creek, 384, 1892; Curtiss, Bedford Co., 1871); California (Peckham, San Buena Ventura, 1866; Leeds, Santa Clara, 1889; Mrs. Brandegee, San Francisco).

Reported also from Monterey, Calif. (Engelm. Bot. Mex. Bound. 193); Texas and New Mexico (Coulter, Bot. West. Tex. 393); upper districts, North Carolina (Curtis, Cat. N. C. Plants 48. 1867); Meriden, Connecticut (Leonard, Cat. Pl. Meriden 29. 1885); West Virginia (Millspaugh & Nuttall, Fl. W. Va. 215. 1896); and from several places in New York and New Jersey by several authors.

B. *Ipecacuanhae.* Lurid colored, usually dioeceous; stems few from a deep perennial root; stem leaves few, entire, with a narrow membranaceous marginal line; the involucres of each sex with rudimentary flowers of the other sex; glands 5, truncate; bracts small and few, or none; calyx well developed, 3-lobed; style fleshy; seeds smooth, without a caruncle.

E. FLORIDANA Chapm. Southern Flora 401. 1860. *E. sphaerosperma* Shuttlew. in Rügel Pl. Exs. 1843 and published by Boiss. in DC. Prod. **15**^{2} : 102. 1862. — Boiss. Icon. Euphorb. *pl. 54.*

Stems 3 to 4 dm. high, usually not branched below the umbel; rays 3 to 4, 2 to 4 times dichotomous, the sterile plants still more branched; rays 3 to 5 cm. long; stem leaves scale-like below to long linear lanceolate above, sessile, slightly narrowed at the base, acute, entire, 3 to 6 mm. wide, 4 to 9 cm. long, reflexed; umbel leaves oblong lanceolate, parallel veined, acute, cordate, 6 to 12 mm. wide, 2 to 5 cm. long; floral leaves similar, but smaller and shorter, 1 to 2 cm. long; involucre 2 to 3 mm. wide, slightly higher, greenish red, a villous spot inside under each gland; peduncle 5 to 12 mm. long; lobes ovate, entire or slightly dentate, densely villous on the edge to almost smooth; glands stipitate, quadrate semilunate, truncate with the edge erose crenate, fleshy, recurved, somewhat concave above, 1 to 1.5 mm. wide, greenish; bracts 5, small, entire, more or less villous; stamens 20 to 25 in staminate involucres; pedicel of pistillate flower 5 to 8 mm. long; calyx lobes ovate lanceolate, acute, 1 mm. long; capsule very depressed ovoid, 6 to 11 mm. across, 4 to 6 mm. high, triangular; sulci shallow; cocci only obtuse; styles 1 to 2 mm. long, united below, short bifid above, slender, subclavate stigmatose; seeds black, depressed globose, 2.5 mm. in diameter, 2 mm. high; chalaza slightly depressed. — Sandy coast plain of west and middle Florida. — Plate 12.

Specimens examined (Rügel, Aspalaga, 1843, *E. sphaerosperma;* Chapman, Gadsden Co., 1835, 1856, 1860; Curtiss, Walton Co., 2479, De

Funiak Springs, 5905, 1897; Rolfs, De Funiak, 173, 1894; Mohr, De Funiak Springs, 1892, Pensacola, 1874).

E. INUNDATA Torrey in Chapm. Southern Flora 402. 1860. Boiss. DC. Prod. 15^2: 102. 1862.

Stems 2 to 5 dm. high, sometimes branched below the umbel; rays 2 to 3, 3 to 6 cm. long, about twice dichotomous in fertile plants, several times in sterile plants; stem leaves few, the lower scale-like, the others linear to oblanceolate linear, acute or mostly obtuse, sessile or attenuate to a short petiole, ascending, 3 to 10 mm. wide, 3 to 10 cm. long; umbel leaves similar or more lanceolate, shorter; floral leaves ovate or ovate oblong, acute or obtuse, rotund or rarely cordate at base; peduncles 1 to 3 cm. long; involucres hemispherical or short turbinate, subpentagonal, 2 to 3 mm. high, broader, hairy beneath the glands inside, reddish, especially at the ends of the lobes; lobes short ovate, subtruncate, lacerate dentate, ciliate, usually longer than the glands; glands irregularly transversely ovate, plane or slightly upturned at the inner edge, the margin rotund to subtruncate, entire or crenate; bracts small, partly adnate to the involucre, ciliate, often obsolete, especially in the fertile involucres; stamens 20 to 25; pedicel of pistillate flower 3 to 6 mm. long; calyx lobes lanceolate or ovate, 1 mm. long; capsule depressed ovoid, subcordate, 5 mm. high, 8 mm. wide; styles 1.5 to 2 mm. long, thick, united at base, bifid above, short clavate stigmatose; seeds ovoid oblong, subquadrate in cross-section, gray, sometimes with small irregular brownish spots, dorsal angle obtuse, base very flat, hilum large, raphe large, yellowish, 2.5 to 3 mm. long, 2 to 2.5 mm. wide, and slightly thicker. — Low pine barren swamps, Alabama to Florida. — Plate 13.

Specimens examined from Florida (Chapman, many forms and collections from Apalachicola and vicinity, first collected in 1836; Buckley, E. Florida; Dean; Palmer, E. Florida, 1874); Alabama (Mohr, Mobile Bay, — pedicels short and glands crenate).

E. TELEPHOIDES Chapm. Southern Flora 402. 1860. Boiss. DC. Prod. **15**^{2}: 102. 1862.

Differs from *E. inundata* as follows: stems thicker, 1 to 2.5 dm. high; leaves broad obovate to oblanceolate, the widest 3 cm. wide, the marginal line conspicuous; umbel leaves no shorter than the rays; floral leaves broad ovate, rotund cordate at base; pedicels shorter; involucre redder; glands more cup shaped; lobes shorter, more entire and more villous on the edges; capsule more cordate. — Sandy pine barrens along the coast in Northwest Florida. Accredited also to Alabama in Mohr, Prelim. List. Plants Ala. 37. 1880. — Plate 14.

Intermediate forms connect this with *E. inundata*, of which species it is scarcely more than a variety.

Specimens examined (Chapman, several specimens of different dates and forms, from Apalachicola; Curtiss, near Apalachicola, 2504).

C. Galarrhoei. Stem leaves alternate, usually serrulate; lobes with a single vein or pinnately veined; glands 4 or 5, their margins rotund and entire; bracts 5, small; calyx none or discoid; seeds carunculate, usually flattened.

* Perennial by a horizontal rootstock; capsule verrucose; glands 5; rays of the umbel 5 or more; seeds ovoid, smooth.

E. DARLINGTONII Gray, Man. 404. 1848; Chapm. Southern Flora 401; Boiss. in DC. Prod. **15**^{2}: 119; Brit. & Brown, Ill. Flora **2**: 378. *E. pilosa* Pursh, Flor. Amer. **2**: 607. 1814. (not Willd.). *E. nemoralis* Darlington, Flora Cestr. 518. 1837. [2d ed.]. (not Kit.). *E. discolor* Shuttl. in Plantae Rügel, and published by Boiss. in DC. Prod. **15**^{2}: 119. 1862. *E. Darlingtonii glabra* Boiss. in DC. Prod. **15**^{2}: 119. 1862. — Brit. & Brown, Ill. Flora *f. 2328;* Pammel, Seed-coats *pl. 12. f. 16.*

Rootstock 1 to 2 cm. thick, with scars of old stems above as in *Polygonatum;* stem 5 to 10 mm. thick, 6 to 12 dm. high, striate; branches in the axils of the upper leaves numerous, similar to the rays, about as long as the leaves;

rays 5 to 8, 5 to 7 cm. long, 1 mm. thick, 1 to 3 times dichotomous; leaves oblanceolate below to lanceolate above, 5 to 10 cm. long, 2 to 3 cm. wide, obtuse or acute, sessile, but tapering at the base, entire, pinnately veined, white pilose beneath or glabrate, inclined to be in groups along the stem; umbel leaves shorter, ovate oblong, often cordate at base; floral leaves broadly ovate, very obtuse or retuse, cordate or truncate at the base, glabrous, 2 to 3 cm. wide, 1.5 to 2.5 cm. long; involucre 3 to 4 mm. high, pubescent or glabrous outside, more or less pubescent inside; lobes obovate or obcordate, incurved, ciliate, with a few lateral nerves; glands irregularly reniform, 2 mm. wide, 1 mm. long; bracts broad, fimbriate and ciliate, adnate to the involucre below, sometimes more than 5; stamens about 15; filament twice the length of the anther; capsule subglobose, 6 to 8 mm. high, 7 to 9 mm. wide, covered with short warts or almost smooth when mature; styles free or slightly united at base, 2 mm. or more long, short bifid above; stigmas short clavate; seeds ovoid or depressed globose, 3 to 4 mm. long, 3 mm. in diameter, smooth or with a few scattering irregular ridges, flattened at the chalaza, color brown; caruncle depressed conical; raphe prominent. — Southeastern Pennsylvania to North Carolina. Not common. — Plate 15.

Specimens examined from Pennsylvania (Darlington, West Chester, 1819, 1827, 1845; Rothrock and Clarke, Center Co.; Green, Mercersburg, 1847; Porter, Mercersburg, 1850–51; Canby, Amedale, 1866, Chester Co., 1864); New Jersey (Lippincott, Swedesboro, 1894); West Virginia (Millspaugh); North Carolina (Curtis, Yancey or Haywood Co., 1844; Rügel, Blue Ridge, 1841; Vasey, 1878, 1881).

Also reported from south of New Garden, Delaware (Tatnall, Cat. Pl. Newcastle Co., Del. 65. 1860); Mts. Md. and Va. (Pursh, Flora Amer. **2**: 607. 1814); New York (Brit. & Brown, Ill. Flora **2**: 378. 1897).

E. HIBERNA Linn. A smaller plant than the latter, with ovate lanceolate floral leaves and more verrucose capsules, is given as a ballast plant in the Torrey Bot. Club Cat. of Anthophyta and Pteridophyta reported as growing spontaneously within one hundred miles of New York City 87. 1888; and at Philadelphia (Martindale, Bot. Gaz. **2**: 58. 1876).

** Annual or biennial or perhaps sometimes perennial by crown buds; rays 5 or less; glands usually 4, transversely elliptical or subreniform; seeds lenticular or reticulate.

+ Capsules verrucose; seeds lenticular.

++ Leaves more or less pubescent; rays usually 5; seeds smooth, shining, a circular depression at the chalaza.

E. PLATYPHYLLA Linn. Sp. Plant. 460. 1753; Boiss. DC. Prod. **15**^{2} : 133; Brit. & Brown, Ill. Flora **2** : 378. 1897; Gray, Man. 405. 1848. (in part), 434. 1868. [5th ed.]; Macoun, Cat. 425. 1886; Hook. Flor. Bor.-Am. **2** : 140. 1840. (?). *Tithymalus platyphyllos* Hill, Hort. Kew. 172 (4). 1768; Scop. Fl. Carn. **1** : 337. 1772. [2d ed.]. *E. verrucosa* Huds. Flor. Ang. 209. 1798. *E. lanuginosa* Thuill. Flor. Paris. 238. 1799. [2d ed.]. *E. subciliata* Pers. Syn. **2** : 18. 1807. *Galarhoeus platyphyllus* Haw. Pl. Suc. 151. 1812. *E. Coderiana* DC. Flor. Franç. **6** : 365. 1815. *E. pilosa* Torr. Compend. Flor. North. and Mid. States 332. 1826. (?). *E. obtusata* Gray, Man. 388. 1857. (in part); Macoun, Cat. 426. 1886. (?). *E. Tannensis* Hort. Boiss. in DC. Prod. **15**^{2} : 133. 1862. *E. foetida* Schult. in Steud. Nom. 1841. (fide Boiss. DC. Prod. **15**^{2} : 133 1862). *E. paniculata* Tenore, Prod. Fl. Nap. lxviii. (fide Index Kewensis). — Brit. & Brown, Ill. Flora *f. 2330;* Pammel, Seed-coats *pl. 12, f. 17a;* Reichenb. Ic. Fl. Germ. *f. 4758.*

Stem single, erect, strictly annual, sparingly branched below the umbel and sometimes at the base, 1.5 to 5 dm. high; rays 5, rarely 3 or 4, dichotomously or at first umbellately branched, then many times dichotomous; primary rays 2 to 10 cm. long, stem leaves oblanceolate spatulate, acute, or the lower obtuse and obovate, spreading or reflexed, subcordate to petiolate at base, serrulate above, 1.5 to 5 cm. long, 5 to 10 mm. wide; umbel leaves oblong; floral leaves triangular ovate, mucronate, subcordate, about 1 cm. long and wide; involucre 2 mm. high, pubescent

with long hairs inside beneath the glands and sometimes outside, lobes oblong obovate, rounded or retuse, irregularly nerved, ciliate with much shorter hairs than those on the rest of the involucre, incurved; glands 1 mm. long, 1.5 mm. wide; bracts 5 to 10, broad, fimbriate, plumose with long hairs; stamens 10 to 15, filament 2 to 3 times the length of the anther; capsule depressed globose, 2.5 mm. high, 3 mm. wide, hardly sulcate, often pubescent; cocci flattened, short verrucose except a line on the back; styles united below, short bifid at the apex; stigmas clavate capitate; seeds 1.9 mm. long, 1.6 mm. wide, 1.1 mm. thick; caruncle small, flat patellate. — Introduced from Europe into the northeastern United States and Canada, mostly about the lakes in the St. Lawrence river valley. — Plate 16.

Specimens examined from Canada (Macoun, Queenstown, Ont., 1882; Shepherd; Cooper, Niagara); Vermont (Brainerd, Bridport, 1882; Pringle, Shelburn, 1879; Oakes, 1829; Boott, Shelburn Bay, 1855; Addison, 1883); New York (Shattock, Poughkeepsie; Engelmann, Niagara, 1856; Cooper, Niagara; Coville, Niagara, 1886; Sheldon, Oswego, 1880; Paine, 1864); Michigan (Boott, Detroit, 1857; Gillman, Detroit, 1849; Morong, Lake St. Clair, 1893; Dodge, Port Huron, 1894; Castelneau, Saganaw); Pennsylvania (Porter, Erie, 1868; Garber, Erie, 1868).

Var. LITERATA (Jacq.) Koch, Syn. Flor. Germ. 627. 1837. *E. literata* Jacq. Collect. **2**: 340. 1788.

Stouter and more pubescent. — Occurs sparingly at New Orleans, Louisiana (Mellichamp, 1898, 1899; Joor).

↔ ↔ Rays usually 3; leaves glabrous; seeds without a chalazal depression, reticulate, or usually almost smooth in *E. obtusata*.

= Seeds large, faintly veiny reticulate or smooth, stem leaves obtuse.

E. OBTUSATA Pursh, Flora Amer. **2**: 606. 1814; Boiss. in DC. Prod. **15**^{2}: 134; Chapm. Southern Flora 401; Gray, Man. 388. 1857. (in part), 434. 1868. [5th ed.]; Brit. & Brown, Ill. Flora **2**: 378. 1897; Hook. Fl. Bor.-Am. **2**: 140. 1840. (is probably *E. platyphylla*). *E. Helioscopia?* Ell. Sketch Bot.

S. C. & Georgia **2**: 658. 1824. (?). *Pythius obtusata* Rafin. Fl. Tell. **4**: 116. 1836. (fide Index Kewensis)· *E. platyphylla* Gray, Man. 405. 1848. (in part). *Tithymalus obtusatus* Kl. & Gar. Tricoc. 69. 1860. *E. dictyosperma* Ward, Flora Washington 110. 1881. — Brit. & Brown, Ill. Flora *f. 2329*. Pammel, Seed-coats *pl. 12. f. 17*.

Stem erect, single, branched above, 2 to 5 dm. high; rays 3, rarely 5, 3 to 7 cm. long, several times dichotomously branched, or the first time trichotomously; stem leaves spatulate oblong, obtuse, subcordate, clasping, sessile, serrulate with ascending teeth, thin, 6 to 11 mm. wide, 2 to 5 cm. long; umbel leaves ovate oblong; floral leaves cordate ovate, longer than wide, 1 to 2.5 cm. long, 8 to 16 mm. wide; involucre about 1 mm. high, smooth; lobes short, retuse or 2 to 3 dentate, one-nerved; glands transversely oblong, usually reddish, sometimes bright scarlet; sinus wide and shallow; bracts 5, small and setiform; stamens 5 to 10; capsule depressed globose, 3 mm. high, 4 mm. wide, trisulcate, covered all over with short cylindrical warts; styles free, 1.5 mm. long, slender, cleft one-third of their length; stigmas nearly capitate; seeds lenticular, black-brown, not so shining as in the last species, 1.7 to 2 mm. long, 1.5 to 1.8 mm. wide, 1.2 to 1.3 mm. thick; caruncle thin, flat. — Usually in damp woods and along streams, from eastern Iowa to northeastern Texas and east to Pennsylvania and North Carolina. — Plate 17.

Specimens examined from North Carolina (Canby, Wilmington, 1867; Curtis; Ashe, Chapel Hill, 1897); Missouri (Hasse, Jefferson Co., 1887; Engelmann, St. Louis, 1867); Ohio (Lloyd, Cincinnati, 1884; Aiken, College Hill, 7662, 1898; Rippos, Toledo); Illinois (Engelmann, American Bottoms, 1834, 1838, 1863; Mead, Warsaw, 1843; Vasey, Morris; Bebb, Fountaindale; Eggert, St. Clair, 1877); Arkansas (Engelmann, 1134, 1835); Kentucky (Short, Lexington, 1835); District of Columbia (Vasey, 1883; Rusby, 1890; Ward, Washington, 1879); Virginia (Pursh, Staunton; Britton & Small, Norfolk Co., 1893); West Virginia (Mertz, Wheeling, 1878); Maryland (Knowlton, 1885); Texas (Reverchon, Dallas, 1874, not mature but with the large capsules of this species); Iowa (Burgess, Carbon, 1878, No. 708b of Arthur's Catalogue).

Reported also from Alabama (Mohr, Prelim. List Plants Ala. 36. 1880); and from Johnson Co., Iowa (Fitzpatrick, Proc. Ia. Acad. Sci. **5**: 162. 1898).

= = Seeds dull, brown, superficially reticulate with wall-like ridges.

1. Cymosely branched; capsule short verrucose; low annuals or occasionally biennial.

E. ARKANSANA Engelm. & Gray, Plantae Lindheimer. in Bost. Journ. Nat. Hist. **5**: 53. 1845; Gray, Man. 388. 1857. [2d ed.]. *E. Helioscopia* Torr. Exp. Red Riv. La. Appx. G. Bot. 282. 1854. (?). *E. dictyosperma* Engelm. Mex. Bound. **2**[1]: 191. 1859; Boiss. in DC. Prod. **15**[2]: 135. 1862. (in part); Gray, Man. 434. 1868. [5th ed.] (and of authors generally, not Fisch. & Meyer). *Tithymalus arkansanus* Kl. & Gar. Tricoc. 66. 1860. *E. obtusata* Coulter, Manual 327. 1885. (?).

Annual, or biennial in the South; stem slender, 1 to 3 mm. in diameter, 2 to 5 dm. high, usually more or less branched at the crown and with spreading branches below the umbel; rays 3, 2 to 3 cm. long, many times dichotomously and diffusely branched, the internodes longer than the leaves, the umbel in typical forms not so long as the main stem; stem leaves few, cuneate to spatulate, sessile or the lower petioled, usually almost acute, serrulate, 1 to 3 cm. long, 5 to 10 mm. wide; umbel leaves oblong or ovate; floral leaves broad triangular ovate to oblong, truncate or subcordate at the base, mucronate, serrulate, 1 cm. wide, 1 to 2 cm. long, the upper ones much smaller; involucre 1 mm. or less high, a line of long hairs below the glands inside or almost smooth; lobes very short, rotund or emarginate, long ciliate to smooth; glands transversely elliptical, yellow, less than 1 mm. wide, over .5 mm. long; fifth gland replaced by a very small lobe or a tuft of hairs; bracts 5, fimbriate and long ciliate; stamens 5 to 15, jointed at the base; capsule depressed globose, short verrucose except in the acute sulci, 2.5 to 3 mm. wide, 2 to 2.5

mm. high; cocci flat or rotund; styles free, spreading, less than 1 mm. long, divided to the middle or less, the tips slender; stigmas clavate capitate; seeds ovoid lenticular, brown, or purplish when immature, with low but sharp, close, wrinkled reticulations, 1.3 to 1.5 mm. long, 1.1 to 1.3 mm. wide, .9 mm. thick; caruncle small, flat and thin. — Very variable and with several well-marked varieties. The typical form is found from eastern Colorado to southeastern Kansas, and south to Mexico and Alabama. — Plate 18.

Specimens examined from Colorado (Eastwood, Platte Riv. 1892); Texas (Lindheimer, 302, 1844–6, 167, 1844, 311, 1845; Wright; Jermy, Gillespie Co.; Wurzlow, Industry, 15, 1893; Hall, Houston, 554, 1872, the seed resembling that of *E. leiococca;* Reverchon, Dallas, 1880; Drummond, 328; Joor, Navarro Co., 1880, Richland, 1880); Arkansas (Dr. Pitcher; Engelmann, 281); Indian Territory (Sheldon, Colberts, 15, 40, 1891; Engelmann, Cherokee Nation, 1132, 1835; Bush, Coal Creek, 549, Vinita, 547, 1894; Butler, Limestone Gap, 1877; Bush, Sapulpa, 548, 1894, 1097, 1895, some of the specimens approaching *E. obtusata* in foliage and having red glands); Missouri (Bush, Dodson, 429, 1896, near var. *Missouriensis*); Louisiana (Hale); Alabama (Buckley, 1840; Mohr, Russell Co., 6); Mexico (Wright, Lake Sta. Maria; Berlandier, 2536, 1834).

A robust, large leaved form with more pubescent involucres is represented by Lindheimer, New Braunfels, Tex., 88, 1848 (Plate 18); Carleton, Muskogee, I. T., 20, 1891; and Joor, Navarro Co., Tex., 1880. Heller, Corpus Christi, Tex., 1475, 1894 (*E. obtusata* Heller, Bot. Expl. South. Tex. 61. 1895), is a peculiar plant with many ascending or decumbent branches from a seemingly biennial root. — Plate 19.

Var. MISSOURIENSIS n. var. *E. obtusata* Torr. Ann. Lyc. N. Y. **2**:244. 1828; Cat. Plant. Fremont Exp. 96. 1845. *Euphorbia platyphylla* Gray, Pac. R. R. Rept. Stevens Exped. 47. 1860. *E. dictyosperma* of most Eastern floras. — Brit. & Brown, Ill. Flora *f. 2331;* Boiss. Euphorb. Icon. *pl. 84.* 1866.

Usually larger and more robust than in the typical form;

umbel not so much branched, and branched rarely at the crown; stem leaves more deeply and grossly serrate, more spatulate; floral leaves, at least the lower, oblong, even the upper ones longer than wide; involucral lobes and bracts smooth; seeds purplish brown when ripe, the reticulations more open and regular. — In the Missouri River Valley, usually in open prairie or waste places, from Missouri to South Dakota and west to Colorado and Idaho, and extending into eastern Washington. — Plate 18.

Intergrading with the species proper on the borders of their ranges, and though possessing very marked characters, it seems best retained under *E. Arkansana*.

Specimens examined from Oklahoma (Blankinship, 1896); Colorado (Eastwood, Denver, 1892, 1897); Nebraska (Clements, St. James, 2621, 1893; Rydberg, Lincoln, 1890; ?Fremont Exped., Little Blue, 1842, perhaps a plant of very dry places; Hayden, Red Cedar Island, 1853, with large seeds and much like var. *Coloradensis*); Kansas (Gayle, Ft. Riley, 631, 1893; Bodin, Lindsborg, 1884; Shear, Osborne Co., 95, 120, 1894; Smyth, Hutchinson, 46, 1890; Oyster, Paola, 1883, near the type; Norton, Manhattan, 1897; Hitchcock, Courtland, 1892; Kellerman, 1895; Norton & Clothier, 481, 1895); South Dakota (Hayden, Ft. Pierre, 1853); Iowa (Harvey, Humbolt, 1874; Hitchcock, Iowa City; Parry, Davenport, 1848); Missouri (Bush, Randolph, 586, 1895; Popenoe, 1875); Idaho (Spalding, Clear Water); Montana (Watson, 356, 1880, seeds large; Hayden, Madison River, 1860); New Mexico (Vasey, Las Vegas, 1881); (Dr. James, on the Missouri, Long Exped.; Havard, Yellowstone Riv., 1878; Stevens, Pac. R. R. Exp.).

Also reported from Minnesota (*E. dictyosperma*), Leiberg, Rock Co. (Upham, Cat. Flora Minn. 123, 1884); Moyer, Montevideo (Sheldon, Minn. Bot. Studies 1: 588. 1896).

Many of the northern specimens examined are smaller, less branched, the leaves more obtuse, more serrate, and in dried specimens of a yellowish color. They are: from Idaho (Heller, Lewiston, 3127, 1896; Sandberg, Hatwai Creek, 256, 1892; Henderson, Clear Water Riv., 1894; Spalding, Clear Water, perhaps from Washington); Montana (Kelsey, Helena, 1888; Blankinship, Custer, 70, 1890; Allen, Yellowstone Exped., 1873, seeds large); South Dakota (Rydberg, Hot Springs, 996, 1892); Washington (Brandegee, Wallawalla, 1072, 1883).

Var. COLORADENSIS n. var.

Somewhat intermediate between var. *atrosemina* and var. *Missouriensis;* characterized especially by the elliptical floral leaves. — Mountains of Colorado, Wyoming and Utah. — Plate 19.

The specimens grouped here are much varied and perhaps with better specimens and more material it will be possible to make a better disposal of them. Jones, Clear Creek Cañon, Col., 239, 1878, and Parry, Rocky Mts., 1862, are typical. Others are: Watson, Antelope Island, Utah, 1880, 1869 (a desert form); Hall, 40°, Col., 1868; Cowen, Larimer Co., Col., 454, 1895; Greene, Golden, Col., 362, 1870. Pammel & Stanton, Sheridan, Wyo., 1897, approaches *E. dictyosperma*. Vasey, Colorado, 514, 1868, has nearly the seed of var. *atrosemina*, but has several stems 2 to 2.5 dm. high and covered with broad, spatulate leaves. A specimen in the National Herbarium, probably of the same collection, is similar, but more robust and resembles *E. obtusata*, though without seed.

Var. ATROSEMINA n. var.

Low, 10 to 15 cm. high, branched from the base and along the short stem, obconical in outline; leaves thick, glaucous; involucre almost glabrous; bracts small; capsule with a few short warts on the upper part of the cocci; seeds very dark brown, closely wrinkled with broken irregular ridges. — From Wyoming, south in the mountains to Arizona and New Mexico. — Plate 20.

Specimens examined from Arizona (Pringle, Santa Rita Mts., 1884; Wooton, Concho, 80, 1892; Toumey, Bradshaw Mts., 253, 1892; Rusby, Prescott, 821, 1883); Colorado (Eastwood, Denver, Platte River, 1892, and Grand Junction; Brandegee, Cañon City, 1877, Soda Springs, 550, 1877; Hall & Harbour, 510, 1862, the same from seed at Athens, Ill., is tall and open); Wyoming (Nelson, Mexican Mines, 581, 1894).

E. MEXICANA (Engelm.) n. comb. *E. multicaulis* Engelm. Mex. Bound. **2**[1]: 191. 1859; Boiss. DC. Prod. **15**[2]: 135. 1862. (not Thuillier, Fl. Paris

238. 1779). *E. dictyosperma Mexicana* Engelm. l. c. *E. dictyosperma multicaulis* Coulter, Bot. West. Tex. 393. 1894.

Stems crowded, erect or ascending, strict, many from a biennial or perennial root, 1 to 2 dm. high, reddish, leafy; umbel 3-rayed, not much branched; stem leaves oblong cuneate to linear cuneate, low crenulate, 3 to 5 mm. wide, 1 to 2 cm. long, obtuse to retuse; floral leaves oblong, acutish; involucre about 1 mm. high; lobes short triangular, rounded or bidentate, with a few short hairs on the margin; glands very small; bracts 5 or more, broad, entire or dentate, smooth; stamens 5 to 10; capsules subglobose, trisulcate; cocci rounded, short verrucose on the upper part, 2 to 2.5 mm. high, 2.5 to 3 mm. wide; styles short, free, deeply bifid; seeds lenticular ovoid, brown, finely low reticulate, 1.4 to 1.6 mm. long, 1 to 1.3 mm. wide, .7 to .8 mm. thick. — Southern Arizona to Texas and in Mexico. — Plate 21.

Perhaps only a variety of one of the northern species, but I follow Engelmann and Boissier in retaining it as a distinct species.

Specimens examined from Texas (Wright, El Paso, 1824, 1851-2); ?Arizona (Thurber, seed only in Engelm. herb.); Mexico (Gregg, Mapimi, 456, 462, 1847, and 1848-9; Thurber, Los Playos, 381, 1951).

Palmer, Walnut Grove, Ariz., 510, 1876; and Thurber, Mule Spring, N. M., 282, 1851, are young specimens, doubtfully referred here, as also is Parish, Calif., near Mex. boundary, with very pubescent lobes and bracts.

E. DICTYOSPERMA Fischer & Meyer, Ind. Sem. Hort. Petrop. **2**: 37. 1835; Boiss. DC. Prod. **15**^{2}: 135. 1862. (in part); Watson, Bot. Calif. **2**: 75. 1880; Greene, Man. Bay Region 80. 1894.

Stem stout, 2 to 3 dm. high, 2 to 4 mm. thick, few to several stems from the base, branched; rays 3, several times dichotomously branched, the umbel longer than

the main stem; stem leaves obovate spatulate, or cuneate, the lower short petioled and retuse or even obcordate, the upper rounded at the apex, 8 to 15 mm. wide, 1 to 3 cm. long, almost entire to crenate serrulate; floral leaves ovate elliptical, low serrulate or crenulate, mostly very obtuse, 6 to 10 mm. wide, 10 to 15 mm. long; involucre broad campanulate; lobes and bracts almost smooth or ciliate with a few short hairs; capsule almost globose, 3 mm. in diameter, with many short warts on the upper part; styles 1 to 1.5 mm. long, free, bifid almost to the base; seeds ellipsoid lenticular, yellowish brown, 1.8 mm. long, 1.3 mm. wide, 1 mm. thick, or often smaller, the depth of the reticulations much varied, netted, usually prominent and forming large areolae. — Southern Washington to Lower California, mostly in the interior. — Plates 22, 23.

Specimens examined from Oregon (Howell, Ashland, 1889; Leiberg, Hoover Creek, 135, 1894; Howell, Roseburg, 721, 1887); California (Eastwood, Brentwood, 1893; M. K. C., Amador Co., 1886; Mrs. Brandegee, Alameda Co., 1892; Hartweg, Sacramento Valley, 1951; Stillman, Upper Sacramento; Palmer, Chico, 2082, 1892; Baker, Modoc Co., 1894; Brewer, Nipoma Ranch, 416, 1861; Fitch, in Herb. Torrey; Snyder, La Jolla, 1895; Mrs. Austin, Chico, 128, 1896; K. C., Antioch, 1883; Torrey, New Almaden, 477, 1865; Brewer, Corral Hollow, 1214, 1861, from a dry hill, leaves thick, much branched, internodes long, seeds deeply reticulated; Parry, 14, 1874, like the last but slender and low and with low reticulated seeds; a specimen from the Harvard Botanical Garden from seed from the St. Petersburg Garden is similar).

A slender form, with thinner leaves and often many stems, which occurs mostly in the southern half of California, is represented by the following: Mrs. Brandegee, Santa Catalina Island; Bolander, Mono Pass, 6414, 1866; Davidson, Los Angeles, 1890; Orcutt, Jumal Valley, 1889.

In the southern range of the species the plants are scarcely over one decimeter high; upper leaves more ovate cordate; styles not so deeply divided. The following are of this form: California (Jones, San Luis Obispo, 3482, 1882; Miles, San Luis Obispo); Lower California (Orcutt, 237, 1882; Brandegee, San Enrique, 1889).

2. Racemosely branched below the small umbel; capsule long warted; a tall mountain perennial or biennial.

E. ALTA n. sp. *E. dictyosperma* Engelm. Euphorb. Wheeler's Exped. 248. 1878.

One primary stem, 2 to 6 mm. thick, 2 to 6 dm. high, or often several stems, sometimes as large, from buds at the crown; the many branches along the stem below the umbel longer than the rays; rays 3, 2 to 3 cm. long, several times short dichotomous; stem leaves oblong spatulate, very numerous, close together below, thin, somewhat glaucous, minutely serrulate, obtuse, 1 to 5 cm. long, 7 to 12 mm. wide; umbel leaves more oblong; floral leaves oblong ovate to ovate, subcordate, obtuse, 6 to 10 mm. wide, 10 to 15 mm. long; involucre 1 to 2 mm. high, glabrous except the short, ovate, ciliate lobes; bracts about 5, spatulate, ciliate; stamens jointed below, 5 to 10; calyx discoid; capsule depressed globose, 3 to 4 mm. high, 4 to 5 mm. broad; sulci prominent; cocci almost covered with cylindrical warts 1 mm. or less long; styles free, bifid above, 1 mm. or less long, recurved when young, incurved when old, slender, tapering upward; stigmas capitate; seeds 1.8 to 2 mm. long, 1.6 to 1.8 mm. wide, 1.2 to 1.4 mm. thick, purple black, with lighter colored low reticulations forming large areolae; caruncle small, thin, flat. — In the mountains of southern Arizona and New Mexico, and in Mexico. The specimens seen are all from 5200 to 9800 feet altitude. — Plate 24.

Specimens examined from Arizona (Pringle, Huachuca Mts , 1884; Toumey, Huachuca Mts., 10, 1894; Engelmann, Santa Rita Mts., 1880; Rothrock, Camp Grant, 370, 1874); New Mexico (Wooton, White Mts., 1895, 285, 1897); Mexico (Forrer, near Durango, 1881; Pringle, Sierra di Pachuca, 6960, 1898, very small).

+ + Annual; capsules smooth; floral leaves widest at or above the middle; seeds deeply exsculptate reticulate.

E. LEIOCOCCA (Engelm.) n. comb. *E. dictyosperma leiococca* Engelm. Mex. Bound. 2^1:191. 1859. *E. Texana* Boiss. Cent. Euph. 30. 1860; DC. Prod. 15^2: 137.

1862; Coulter, Bot. West. Tex. 393. 1894. — Boiss. Euphorb. Icon. *pl. 87.* 1866.

Entirely glabrous, stems several from the crown, slender, 10 to 17 cm. high, branched below the 3-rayed umbel; rays 2 to 3.5 cm. long, dichotomous, or trichotomous and then several times dichotomous, stem leaves attenuate cuneate, obtuse, mucronate, crenate near the apex, 8 to 15 mm. long, 2 to 4 mm. wide; umbel leaves similar; floral leaves more elliptical or obovate, somewhat shorter and wider; involucres hemispherical, 1 mm. high; lobes short, bidentate; bracts 5, short; stamens usually 5; glands almost always 5, elongated reniform; capsule depressed globose, 2.5 to 3 mm. wide, 2 mm. high; cocci rounded or somewhat flattened; calyx distinctly discoid or triangular; styles free, spreading, deeply bifid, flattened, 1 mm. long; stigmas small, capitate; seeds brownish black, globose lenticular, about 6 areolae to the length of the seed, a distinct line on the back and a triangular space under the caruncle, 1.5 mm. long, 1.3 mm. wide, 1 mm. thick; caruncle small, low conical. — Southern Texas. — Near *E. Arkansana* and *E. Mexicana*. — Plate 25.

Specimens examined (Hall, Houston, 555, 1872; Joor, 1877; Drummond, 327, "E. Tex.," 1835?; "Hooker, Tex. 14," in herb. Engelmann).

E. Helioscopia Linn. Sp. Plant. 459. 1753; Gray, Man. 405. 1848; Boiss. DC. Prod. **15**^{2}: 136. 1862; Brit. & Brown, Ill. Flora **2**: 379. 1897; Macoun, Cat. 426. 1886. *Tithymalus Helioscopius* Hill, Hort. Kew. 172 (3). 1768; Scop. Fl. Carn. **1**: 337. 1772. [2d ed.]. *Galarhoeus helioscopius* Haw. Pl. Suc. 152. 1812. *Tithymalus serratus* Gilib. Fl. Lituan. **2**: 207. 1781. (fide Index Kewensis). *Euphorbion helioscopium* St. Lager, Ann. Soc. Bot. Lyon **7**: 126. 1880. See *E. obtusata* and *E. Arkansana*. — Reichenb. Ic. Flor. Germ. *f. 4754;* Brit. & Brown, Ill. Flora *f. 2332;* Pammel, Seed-coats *pl. 12. f. 18a.*

Stem single, 1 to 3 dm. high, 3 to 6 mm. thick, slightly

swollen below the umbel, a few long scattering hairs above, sometimes sparingly branched at the base or below the umbel; rays 5, 3 to 4 cm. long, trichotomous, then several times dichotomous; stem leaves spatulate obovate, serrate, obtuse or retuse, the lower attenuate into a petiole, .5 to 4 cm. long, 3 to 15 mm. wide; umbel leaves similar, but larger; floral leaves elliptical or obovate, somewhat oblique, smaller and wider in proportion than the stem leaves; involucre 2 mm. high, pubescent inside beneath the glands with long, straight hairs; lobes small, oblong, fimbriate, ciliate; glands 4, transversely elliptical, yellowish, 1 mm. wide, .5 mm. long; the fifth gland replaced by a small fimbriate lobe; bracts 5, slender, 1 mm. long, plumose at the apex with long hairs; stamens about 15; capsule subglobose, cordate below, smooth, 2.5 to 3 mm. high, 3.5 to 4 mm. wide; cocci rotund; sulci deep; styles 1 mm. long, free, bifid above, clavate stigmatose; seeds ovoid subglobose, acute at apex, yellowish brown; 2 mm. long, 1.5 mm. in diameter; areolae on the surface .2 to .3 mm. wide, their walls prominent, caruncle transversely elliptical, vertical. — Waste places in the lake regions of the northeast United States and Canada. Introduced from Europe. — Plate 26.

Specimens seen from Canada (Short, 1852; Fowler, Kingston, Ont., 1885; Allen, River du Loup, Queb., 1890; Northrop, Notre Dame du Lac, 225a, 1887); Pennsylvania (Martindale, Philadelphia, 1876; Porter, Erie, 1868); New York (Paine, L. Onondago, 1864; Clinton, Buffalo; Coville, Norwich, 1886; Troy; Sartwell, Penn Yan and Lake Erie; Hayden; Kennicott, Buffalo); Michigan (Rusby, Detroit, 1884; Wheeler, Mackinac Is., 1881, 1892; Millspaugh, Mackinac Is., 1898; Holton, Mackinac Is., 1850); Maine (Fernald, Farmington, 1894); Ohio (Sartwell, Maumee; Werner, Painesville, 1891, 1892); Illinois (Hall, Athens, 1867); Vermont (South Haven, 1896).

Also reported from Illinois (Patterson, Cat. Pl. Ill. 37, 1876); and Pictou, Nova Scotia (Sommers, Flora Nova Scotia 207).

D. *Esulae.* Stem leaves alternate, usually entire; glands 4 or 5, their outer edge not rotund, entire, usually more or less bicornute; calyx inconspicuous, triangular or discoid, seeds carunculate, oblong or ovoid, circular or rhombic in cross-section.

* Main stem short; leaves crenulate, most of those in the tricho-

tomously branched umbel alternate; bracts many; seeds ovoid, smooth; caruncle small.

E. TRICHOTOMA Kunth in Humbolt & Bonpland, Nov. Gen. **2**: 60. 1817; Boiss. DC. Prod. **15**²: 105. 1862; Chapm. Southern Flora 402. 1860. *E. dumosa* Rich. in Sagra, Cuba **11**: 198. 1850. *Tithymalus trichotomus* Kl. & Gar. Tricoc. 81. 1860. *E. Sagraeana* Rich. MS. in Boiss. Euph. in DC. Prod. **15**²: 105. 1862. — Boiss. Icon. Euph. *pl. 58.*

Glabrous throughout, somewhat woody, many stems erect from the root, branched at the base, then after an interval 3- or 4-chotomous; 2 to 5 dm. high; the first branches 3 to 5 cm. long; leaves all alike, crowded, obovate or lanceolate, obtuse or acute, sessile, 5 to 12 mm. long, 2 to 4 mm. wide; involucres few, 2 mm. wide, subglobose, not membranaceous, pubescent inside, especially below the glands; lobes incurved, short oblong, dentate, hirsute to smooth; glands semilunate, dentate between the short horns, spreading, stipitate, 1 mm. wide, yellow; bracts fimbriate and hirsute or ciliate; stamens about 10, filaments very short; capsule depressed ovoid, 4 mm. wide, 3 mm. high; cocci rotund, minutely papillose; sulci deep; pedicel 4 to 8 mm. long, smooth; style very short, clavate stigmatose, shortly bilobed; seeds ovoid globose, 1.6 mm. wide, 1.8 mm. long, white, a slight ridge on the back; raphe large and black; chalaza flat; caruncle very small. — Florida, West Indies and Eastern Mexico. — Plate 27.

Specimens examined from Florida (Chapman, Little Sarasota Bay, 1875, Key West, 1886; Curtiss, Jupiter Inlet, 5539, 1895, Cape Malabar, 2502; Nash, Tampa, 2421, 1895; Palmer, Key West and Indian River, 506, 1874; Leavenworth, Tampa, 1829; Garber, Manatee, 1878; Herb. Thurber, E. Fla.; Blodgett, Pine Key and Key West; Merrill, Key West, 1886); Cuba (Herb. Bernhardi, Matanzas; Reichenbach; Wright, 354); Yucatan (Gaumer, 1885).

** Rays dichotomously branched; floral leaves opposite; glands usually 4; bracts few, usually 5, sometimes obsolete; caruncle well developed.

+– Thin leaved wood or field annuals or biennials with fibrous roots;

glands crescent shaped, horned; capsules subglobose; seeds variously marked, more or less flattened or angled.

++ Floral leaves acute or acuminate, very inequal; capsular angles almost acute; styles .5 mm. long; seeds tuberculate.

E. EXIGUA Linn. Sp. Plant. 456. 1753; Boiss. DC. Prod. 15^2 : 139. 1862; Greene, Man. Bay Region 80. 1894. *Tithymalus exiguus* Hill, Hort. Kew. 172 (3). 1768; Lam. Fl. Fr. **3**: 100. 1778. (fide Index Kewensis). *Esula exigua* Haw. Pl. Suc. 158. 1812. *Keraselma exigua* Rafin. Fl. Tell. **4**: 116. 1836. (fide Index Kewensis). — Reichenb. Ic. Flor. Germ. *pl. 4777.*

Simple or branched from the base, 1 to 2.5 dm. high, striate, branched below the umbel; rays 3 to 5, many times dichotomous, 2 to 3 cm. long; stem leaves 1 to 10 mm. apart, entire or minutely tuburculate serrulate, acute or obtusish, sessile, 1 to 2 mm. wide, 3 to 25 mm. long; umbel leaves similar, but dilated at the base; floral leaves lanceolate, connate on one side, sometimes with a large tooth on that side, 2 to 4 mm. wide, 6 to 12 mm. long; involucral lobes triangular ovate, truncate, acute or bidentate, smooth, erect or incurved; glands transversely oval, the two next the sinus larger; horns as long as the width of the gland, diverging from beneath the gland; fifth gland replaced by a very small lobe or none; bracts small, filiform, smooth; stamens 5 to 10; capsule ovoid, almost triangular, 1.5 to 2 mm. in diameter; styles free, bifid, clavate stigmatose; seeds quadrangular ovoid, slightly flattened, the inner faces concave, angles almost acute, 1.2 mm. long, .7 to .8 mm. wide, or as much as 1.5 mm. long in large plants; caruncle small, low conical.—Sparingly introduced from Europe in a few localities. — Plate 28.

Specimens examined from New Jersey (Buck, Kaighn's Point, 1866); New York (Day, Buffalo, 1896; also as ballast plants about New York City); California (Leeds, Santa Clara, 1888).

++ ++ Leaves obtuse; capsular angles rotund; styles 1 mm. long; seeds smooth or microscopically tuberculate.

E. HELLERI Millspaugh, Bot. Gaz. **26**: 268–270. *f.*

1898. *E. commutata* Coulter, Contrib. Nat. Herb. **1**: 48. 1890. *E. tetrapora* Heller, Bot. Explor. South. Tex. 61. 1895.

Many stems from the crown, a few branches below the umbel, 15 to 25 cm. high, smooth; rays 3, 3 to 5 cm. long, many times dichotomous with long internodes; stem leaves spatulate, obtuse or retuse, petioled, 6 to 15 mm. long, 3 to 5 mm. wide; umbel leaves oblong, almost sessile; floral leaves orbicular ovate, subpandurate, unequal, obtuse, mucronate, broad cuneate to truncate at base; involucre about 1 mm. long; lobes incurved, ovate, truncate, ciliate; glands elliptical, about twice as wide as long, horns as long as the body of the gland; fifth gland similar to the lobes but shorter; bracts filiform, a few hairs at the tip; stamens about 10; capsule depressed globose, 2.5 mm. high, 3 mm. wide; cocci flattened, smooth; styles slightly united at the base; stigmas clavate, recurved; seeds ovoid, white, inner faces flattened, an indistinct angle on the back, 1.4 to 1.6 mm. long, 1 to 1.2 mm. wide, almost as thick; caruncle thin but raised into a cone, bilobed. — Southern Texas. — Plate 29.

Specimens examined (Heller, Corpus Christi, 1509, 1894; Nealley, Brazos Santiago, 71=442, 1889).

↔ ↔ ↔ Capsular angles decidedly obtuse; seeds marked with pits, some of which are in rows.

= Capsule bicrested on the back of each coccus.

E. PEPLUS Linn. Sp. Plant. 456. 1753; Boiss. DC. Prod. **15**^{2}: 141. 1862; Pursh, Flor. Amer. **2**: 606. 1814; Gray, Man. 405. 1848. (in part); Macoun, Cat. 426. 1886; Greene, Man. Bay Region 80. 1894; Brit. & Brown, Ill. Flora **2**: 379. 1897. *Tithymalus Peplus* Hill, Hort. Kew. 172 (3). 1768; Gaertner, Fruct. **2**: 115. 1791. *T. rotundifolius* Lam. Fl. Fr. **3**: 100. 1778. (fide Index Kewensis). *Esula Peplus* Haw. Pl. Suc. 158. 1812. *E. minima* Haw. l. c. *E. rotundifolia* S. F. Gray, Nat. Arr. Brit. Plants **2**: 257. 1821.

Keraselma oleracea Rafin. Fl. Tell. **4**: 116. 1836. (fide Index Kewensis). *K. Peplus* Rafin. l. c. *Euphorbion peplum* St. Lager, Ann. Soc. Bot. Lyon **7**: 125. 1880. — Reichenb. Ic. Fl. Germ. *f. 4775;* Brit. & Brown, Ill. Flora *f. 2333;* Pammel, Seed-coats *pl. 12. f. 18e.*

Many branches from the base and below the umbel; stem 12 to 30 cm. high, erect or ascending, the lower branches often almost as high as the axis, striate; rays 3 to occasionally 5, 1.5 to 4 cm. long, many times branched; cotyledons elliptical; stem leaves obovate or rotund, obtuse or retuse, very thin, crisped, 5 to 25 mm. long, 4 to 12 mm. wide; petioles 1 cm. or less long; umbel leaves little different, sessile; floral leaves somewhat oblique, ovate, slightly pandurate, obtuse at both ends, sometimes mucronate, 5 to 10 mm. wide, 6 to 15 mm. long, involucre about 1 mm. high and wide; lobes triangular ovate, ciliate with short thick hairs; glands .5 mm. long, one-half wider; horns much longer, spreading, the two next the sinus longest; bracts flattened filamentous, ciliate at the end; stamens 10 to 15; capsule depressed globose, 2 to 2.5 mm. in diameter; cocci rounded; sulci deep; styles only .5 mm. long or less, free, deeply bilobed; seeds white, ovoid oblong, sub-hexagonal, 1.3 mm. long, .8 mm. wide, the two inner faces each with a large longitudinal sulcus, the four external each with about 3 large shallow pits in longitudinal rows, sometimes additional pits between the rows, or even 6 rows; caruncle conical, white. — Introduced from Europe into the northern United States and Canada from Wisconsin to Nova Scotia, south to Iowa and New Jersey; also in California and Alabama. — Plate 30.

Specimens examined from New York (Brown, New York, 1879, 1880, ballast; Coville, Oxford, 1884; Clute, Binghamton, 1896; Day, Buffalo, 1845; Haberer, Utica, 1883); California (Leeds, Santa Clara, 1889, 1888; Michener & Bioletti, Berkeley, 1892); New Jersey (Parker, Camden, 1866, ballast); Pennsylvania (Wolle, Bethlehem, 1846; Porter, Lancaster, 1861, floral leaves petioled; Small, Lancaster, 1895); Maine (Furbish, Brunswick, 1891); Massachusetts (Sprague; Boott, Boston, 1853);

Illinois (Hall, Athens); Wisconsin (Trelease, Madison, 1882; Kellerman, Oshkosh, 1878); Ontario (Macoun, Ottawa, 1892); Nova Scotia (Burgess, Pictou, 1883); Ohio (Spence, Springfield, 1879; Mosely, Sandusky, 1895); Alabama (Mohr, Mobile, 8); Iowa (Reppert, Muscatine).

Also reported from Rhode Island (Tweedy, Bull. Tor. Bot. Club **9**: 23. 1882; San Bernardino, Cal. (Parish, Erythea **3**: 61); and Monterey and San Francisco, Cal. (Hook. & Arn. Bot. Beechey's Voy. 159, perhaps *E. crenulata*).

=== Capsule smooth or with very slight ridges on the back of the cocci.

E. PEPLIDION Engelm. Mex. Bound. 2^1: 191. 1859; Boiss. DC. Prod. 15^2: 142. 1862; Coulter, Bot. West. Tex. 394. 1894. — Boiss. Icon. Euph. *pl. 93.*

Stems erect, 1 to several from buds at the crown, slender, striate, 5 to 20 cm. high, a few branches just below the umbel; rays 3, 1 to 2 cm. long, a few times dichotomously branched; stem leaves linear cuneate, obtuse or the upper sometimes acute, tapering to a petiole, close together on the stem, 5 to 20 mm. long, 1 to 4 mm. wide; umbel leaves linear or lanceolate or spatulate, dilated at the base, 12 to 20 mm. long; floral leaves rhomboid lanceolate to ovate, falcate, acute, somewhat erose margined; involucre broad turbinate, less than 1 mm. high; lobes deeply cut, dentate, obovate, ciliate; glands stipitate, .2 mm. long, .5 mm. wide, horns much longer; bracts very small or obsolete, a tuft of hairs at the apex; stamens 5 to 10; capsules depressed globose, 2 mm. high, 3 mm. broad, smooth; cocci flattened on the back; sulci deep; styles .5 mm. long, free or nearly so, divided almost to the base; seeds oblong, diagonally truncate above, subhexagonal, 1.3 mm. long, .9 mm. wide, the inner faces with one large depression each, the four outer with 2 to 3 depressions each, or these sometimes irregularly arranged; chalazal depression large; caruncle flat, umbonate, bilobed. — Sandy and stony places in central and southern Texas. — Plate 31.

Specimens examined (Wright, Austin, 1850, east of the San Pedro, 1823, 1851; Hall, Austin, 557, 1872; Reverchon, Upper Concho, 136, 1354, 1882; Berlandier, 1664; Croft, San Diego, 74, 1885, the stem winged; Reverchon, Sabinal, 141, 1885).

E. TETRAPORA Engelm. Mex. Bound. **2**[1]: 191. 1859; Boiss. DC. Prod. **15**[2]: 142. 1862; Chapm. Suppl. South. Flora 646. 1883; Coulter, Bot. West. Tex. 394. 1894. *E. tetrapora Berlandieri* Boiss. DC. Prod. **15**[2]: 142. 1862. *E. peplidion* Holzinger, Cont. U. S. Nat. Herb. **1**: 216. 1892.

Stem erect, simple or with a few branches from the crown and below the umbel, 7 to 25 cm. high; rays 3, 1.5 to 3 cm. long, several times branched; cotyledons ovate elliptical, 3 to 5 mm. long, 2 to 3 mm. wide, with a petiole 2 mm. long; stem leaves cuneate spatulate, attenuate into a petiole, retuse or obcordate, the lower 1 mm. wide and 3 mm. long, 7 mm. wide and 20 mm. long above; internodes one-third as long; umbel leaves more obovate; floral leaves triangular ovate, mucronate, truncate or cordate at the base, subconnate, sometimes subpandurate, 7 to 14 mm. wide, 5 to 10 mm. long; involucres about 1 mm. high and broad, smooth except the ovate lobes which are short ciliate; glands 1 mm. wide, less than half as long, short stipitate; horns about 1 mm. long, diverging or usually erect; fifth gland replaced by a small lobe; bracts very small; stamens 10 to 15; capsules subglobose, 2.5 mm. in diameter; cocci rounded or somewhat flattened with a low ridge on each side the dorsal suture; styles .5 to 1 mm. long, united at the base, short bifid at the apex, capitate stigmatose; seeds oblong, slightly flattened, microscopically tuberculate, 4 to 6 large shallow pits on the inner faces, these sometimes confluent into irregular oblong grooves; the back with 15 to 20 irregularly arranged shallow pits or almost smooth, 1.3 to 1.4 mm. long, .8 to .9 mm. wide, .7 mm. thick; caruncle hat shaped, usually large. — Indian Territory to Texas, east to Georgia. — Plate 32.

Specimens examined from Texas (Reverchon, Dallas, 884, 1881, 1876; Lindheimer, 1839; Wright; Thuron, Hockley, 3, 1889; Jermy, Gillespie Co., 162; Joor, Houston, 1877; Wurzlow, Industry, 15, 1893); Indian Territory (Palmer, 298, 1868); Louisiana (Hale, Red River).

Also reported from Georgia (Chapman, Bot. Gaz. **3**: 12. 1878).

The more pitted form (var. *Berlandieri* Boiss.) is represented by Hall, Houston, Tex., 556, 1872; Joor, Tex., 1880; Mohr, Alabama; Bush, Sapulpa, I. T., 1194, 1895; Carleton, Oklahoma City, Okla., 126, 1891. The last two have a more compact inflorescence, stouter growth and thicker leaves. Boissier gives Berlandier, 1664, near Bejar, Tex., as the type of the variety (DC. Prod. **15**^{2}: 142. 1892).

++ ++ ++ ++ Seeds covered with irregularly arranged pits or broad ridges.

= Seeds white, pitted with 50 to 100 small, deep pits.

E. LONGICRURIS Scheele, Linnaea **22**: 152. 1849; Boiss. DC. Prod. **15**^{2}: 142. 1862; Coulter, Bot. West. Tex. 394. 1894. *E. peploides* Nutt. Trans. Am. Phil. Soc. n. s. **5**: 172. 1837. (not Gouan); Engelm. Mex. Bound. **2**^{1}: 191. 1859. *E. Lindheimeriana* Engelm. MS., Boiss. in DC. Prod. **15**^{2}: 142. 1862.

Stems one or more with a few branches later below, 1 to 2 dm. high, branched below the 3-rayed umbel; rays 1 to 3 cm. long, many times dichotomous, with very short internodes; stem leaves 1 to 8 mm. apart, cuneate spatulate below to obovate above, 2 to 6 mm. wide, 5 to 15 mm. long, mucronate, obtuse to retuse, the lower petioled; umbel leaves obovate; floral leaves usually imbricated, reniform or semi-orbicular, slightly connate, very unequal, 7 to 13 mm. wide, 4 to 7 mm. long; involucre 1.5 to 2 mm. high, 1 to 1.5 mm. long; lobes oblong, minutely ciliate; glands crescent shaped, the very broad horns twice as long as the body, erect, and sometimes lobed; stamens 10 to 15; bracts filiform, pubescent at the tip; capsule ovoid spherical, subcordate, 2.5 mm. long, 2.5 to 3 mm. wide; calyx a conspicuous disc; styles .5 mm. long; seeds oblong, slightly flattened, 1.5 mm. long, 1.1 mm. wide, 1 mm. thick, a slight ridge on the back; diameter of the pits less than one-half the space between them; chalazal projection prominent; caruncle small, depressed conical, umbonate. —

Indian Territory and Arkansas to southern Texas. — Plate 33.

Specimens examined from Arkansas (Nuttall); Indian Territory (Sheldon, Caddo, 39, 1891; Palmer, 298, 1868); Texas (Orcutt, Santa Anna, 90; Wright, 1822, 1851–52, 1849; Nealley, 1888, 1890; Hall, Austin, 558, 1872; Drummond, 331; Lindheimer, 17, 331, 529, 313, 698, 90, 1845–48; Pope; Joor, Navarro Co., 1880; Jermy, Gillespie Co., 161, 186).

E. COMMUTATA Engelm. in Gray, Man. 389. 1856. [2d ed.]; Brit. & Brown, Ill. Flora **2**: 380. 1897; Chapm. Southern Flora 401. 1860; ? Macoun, Cat. 426. 1886. *E. Peplus* Gray, Man. 405. 1848. (in part). *E. Ohiotica* Steud. & Hochst. in Frank Pl. Amer. Exs. 1857, published first by Boissier in DC. Prod. **15**^{2}: 142. 1862. *Tithymalus commutatus* Kl. & Gar. Tricoc. 82. 1860. — Brit. & Brown, Ill. Flora *f. 2334;* Pammel, Seed-coats *pl. 12. f. 19.*

Annual, or perennial by new stems arising from the decumbent base of those of the previous year, which persist over winter; 1.5 to 3 dm. high, ascending; stems one to many, branched below the umbel, often many short sterile leafy branches below; rays 3, 3 to 6 cm. long, many times dichotomously branched; stem leaves obovate, obtuse or retuse, the lower tapering into a petiole sometimes 1 cm. long, 5 to 30 mm. long, 3 to 10 mm. wide; leaves on sterile branches oblanceolate, almost acute; umbel leaves wider, ovate cordate or elliptical; floral leaves broad triangular reniform, subconnate, subcordate or the upper ones only truncate, 10 to 20 mm. wide, 5 to 12 mm. long; involucres 1 to 2 mm. high and wide, whitish, glabrous except the oblong, ciliate lobes; glands 1 to 1.5 mm. wide, less than 1 mm. long, yellow or brown when old, with slender white horns twice as long, often toothed between the horns; fifth gland replaced by a small triangular lobe; bracts very small; stamens 10 to 15; capsules ovate globose, 3 mm. in diameter; cocci somewhat flattened on the back, faintly punctate; styles slender, united at the base, deeply bifid above, 1 mm. long; stigmas capitate;

seeds oblong or sometimes subglobose, slightly flattened, 1.8 mm. long, 1.4 mm. wide, 1.2 mm. thick, white, sometimes a row of larger pits on each side the raphe; caruncle depressed conical, short stipitate, nearly as broad as the seed. — Along water-courses and in moist sandy woods, Pennsylvania to North Carolina and west to Wisconsin and Texas. Also in Montana, and a variety in Florida, and will perhaps be found in the intervening States. Perhaps connecting with *E. crenulata* in the northern part of the latter's range, but separable, in all specimens examined with mature seeds, by the surface markings of the seeds. — Plate 34.

Specimens examined from Missouri (Eggert, St. Louis, 1879; Bush, Wayne Co., 1893, McDonald Co., 1891, Shannon Co., 1888, 1891, Eagle Rock, 73, 1897, Bismark, 1893; Trelease, St. Francois Co., 870, 871, 1897; Glencoe, Pammel; Mrs. Brent, Crystal City, 1897; Pammel, Allenton, 1887; Tracy, 1886; Letterman, Allenton, 1875, 1899; Engelmann, St. Louis Co., 1835, 1845; Mann, Wright Co., 1891; Dewart, Potosi, 84, 1892); Illinois (Bebb, Fountaindale, 1870, Ogle Co., 1856, Byron; Munroe, Riverside, 71, 1874; Herb. Babcock, Chicago; Vasey, Dixon, 1861); Virginia (Redfield, Giles Co., 7362, 1876; Curtiss, Roanoke Co., 2471, 1872; Buckley, James Riv., 1838; Brown et al., Roanoke, 1890); District of Columbia (Steele, 1896; Vasey, 1873, 1882; Coville, 1890); Ohio (Frank, 1835, *E. Ohiotica;* Riddell, Cincinnati; Sullivant, Columbus, 1840; Lapham, Columbus, 1835; Riddell, Worthington; Kellerman, Union Co., 1897, Franklin Co., 1894, Licking Narrows, 1894; James, Loveland, 1878; Werner, Franklin Co., 1892; Classen, Marblehead, 1891); Indiana (Canby, Madison, 15, 1863); Kentucky (Palmer, Bullett Co., 1888; Short, Lexington, 1831, 1835); Texas? (Heller, 1573); Pennsylvania (Sandberg, Susquehanna, 1882; Heller, Lancaster Co., 1891; Porter, Lancaster Co., 1858–61; Small, Safe Harbor, 1891; Heller, Safe Harbor, 1890); Montana (Ward, 1882); West Virginia (Heller, Mt. Crawford, 814, 1893); Virginia (Harper's Ferry); Wisconsin (Hale, Beloit, 1861); Tennessee (Gattinger, Nashville, 1882; Bicknell, Nashville, 1894; von Schrenk, Murfreesborough, 1899, in flower Mar. 16); Iowa (Holway, Decorah, 1893); Georgia (Nuttall).

Also reported from Michigan (Winchell, Rept. Geol. Surv. Mich. 291, 1861; Wheeler & Smith, Cat. 67, 1881) and Alabama (Mohr, Prel. List Pl. Ala. 36. 1880).

Var. ERECTA n. var.

More erect and strict in habit; stem leaves more lanceolate and long petioled; apparently strictly annual. — Florida.

Represented by Chapman, Apalachicola, 1836; Croom, 1836; Curtiss, Chattahoochee, 2471; Canby, Hibernia, 1869.

= = Seeds pitted with broad shallow pits with wide ridges between; leaves more or less connate.

E. ROEMERIANA Scheele, Linnaea **22**: 151. 1849; Boiss. DC. Prod. **15**^{2}: 143. 1862; Coulter, Bot. West. Tex. 394. 1894. — Boiss. Icon. Euph. *pl. 94.* 1866.

Stems few, or later some small ones from the base, branched below the umbel, slender, 1.5 to 3 dm. high, .7 to 2 mm. in diameter; rays 3, ascending, 5 to 7 cm. long, 3 or 4 times branched, with long internodes; leaves far apart, obtuse or retuse or obcordate below, abruptly narrowed into a petiole 3 to 5 mm. long, very thin, 5 by 5 mm. below to 10 mm. wide, 20 mm. long above; umbel leaves ovate, very obtuse, 7 mm. wide, 15 mm. long or larger; floral leaves semi-circular, connate to the middle, 10 to 20 mm. wide, 7 to 10 mm. long; involucre campanulate, very thin, 1.5 to 2 mm. high; lobes broad oblong, minutely ciliate; horns of glands shorter than the body, usually incurved; glands 1 mm. wide, 1 mm. long including the horns; bracts insignificant; capsule subglobose, 3 mm. in diameter; styles 1.5 mm. long; seeds oblong ovate, somewhat flattened, dimensions 1.6 to 1.8 mm. by 1.4 to 1.5 mm. by .9 mm., rather deeply broad pitted; chalazal space prominent; caruncle small, low conical, umbonate. — Southern Texas. — Plate 35.

Specimens examined (Lindheimer, New Braunfels, 89, 528, 699, 1846-7; Wright, Blanco).

E. CRENULATA Engelm. Mex. Bound. **2**^{1}: 192. 1859. *E. leptocera* Engelm. in Torr. Bot. Whipple Exped. Pac. R. R. Reports **4**: 135. 1856. (name only); Boiss. DC. Prod. **15**^{2}: 143. 1862; Watson, Bot. Calif. **2**: 75. 1880; Greene, Man. Bay Region 80. 1894. *E. lep-*

tocera crenulata Engelm. in litt. in Boiss. DC. Prod. **15**[2]: 143. 1862.

Stems few to several, 1.5 to 3 dm. high, 2 to 4 mm. thick, branched below the umbel, erect or declined at base; rays 3 to 5, 2 or 3 times branched, 2 to 5 cm. long; leaves crowded below, 1 to 2 cm. apart above, spatulate to obovate, acute to retuse, 10 to 20 mm. long, 3 to 10 mm. wide, tapering to a petiole 2 to 3 mm. long, or sessile; umbel leaves wider, obovate to ovate; floral leaves triangular ovate, base truncate, connate, especially on the outside, or nearly free, 10 to 20 mm. wide, 7 to 11 mm. long or sometimes larger, all the leaves usually erose denticulate; involucre 2 mm. high, 1 mm. wide; lobes truncate or dentate; glands 2 mm. wide, 1 mm. long, the white horns as long or longer, diverging; bracts thread-like, lobed or entire, smooth or sometimes pubescent; capsule 2.5 to 3 mm. long, 3.5 to 4 mm. wide; styles 1.3 to 2 mm. long, slightly united at the base; seeds oblong ovoid to nearly spherical, truncate above, slightly flattened on the inner face, covered with irregular vermiculate ridges and large shallow pits to occasionally tuberculate or even almost smooth, a prominent ridge on the back, white or brownish. — Common mostly in the central valleys of California; also in Oregon, southern California, Arizona, and Colorado. The Oregon forms approach *E. commutata*. — Plate 36.

Specimens examined from California (Hansen, Elsie's Creek, 1094, 1895, 274, 1894; Brown, Shasta Co., 291; Dodd, Yosemite, 1891, seed almost tuberculate; Brandegee, Santa Inez Mts., 1888; Eastwood, Millwood, 1896, Sansalito, 1896; Blaisdell, Big Trees, 40; Eisen, Fresno, 1879; Fritchey, Yosemite, 57; Baker, Modoc Co., 1893; Bigelow, Grass Valley, 1853-4; Wilkes Exped., San Francisco, 1404; Newberry, La Pagosa, 1859; Palmer, Marin Co., 2409, 1892; Mt. Shasta, 2486, 1892; Brown, Sisson, 291, 1897; Austin, Colby, 268, 1896; Ames, Plumas Co., 1875; Bridges, 296; Hartweg, 1950; Cooper, Santa Inez Mts., 1879; Peckham, Ojai; Lemmon, Calaveras Grove; LeConte, Mt. Shasta, 1882; Hansen, Amador Co., 1095, 1892, 1067, 1895, 1977, 1896; Parry, 1874; Rattan, Sierra Nevada; Brewer, 618, Monterey, 1860–62; Nuttall; Wrangel; Pringle, Santa Cruz Mts., 1882; Vasey, Santa Lucia Mts.); Oregon (Hall, 1871; Howell, Milwaukee, 300, 1880, Umpqua Valley, 87, 1881); Arizona (Lemmon, Rucker

Valley, 578, in part, 1881); Colorado (Baker, Earle & Tracy, Mancos, 23, 1898).

On the southern coast of California and the adjacent islands occurs a large form with large deeply cordate floral leaves. Specimens examined that may be referred here are: Vasey, Angel Island, 1875; Brewer, Atascadero, 516, 1861; Trask, Santa Catalina Island, 1896–7. Several of the inland specimens approach these in size and leaf form.

Var. FRANCISCANA n. var.

Seemingly perennial, several to many stout stems from a perpendicular rootstock (?), 3 to 6 mm. in diameter, and tapering into the root; inflorescence smaller; leaves oblanceolate, acute, or the upper obtuse, thicker, whitish beneath; glands darker, larger; capsule depressed ovate, 3 mm. long, 4 mm. wide; styles 1 mm. or more long. — In the San Francisco Bay region, whence the name. — Plate 37.

Specimens examined (Bolander, San Francisco, 20, 1865, cult. fields; Brewer, Oakland, 2762, 1864; Kellogg, Lone Mt. Cemetery, 1877; Jones, San Francisco, 3249, 1882; Kellogg & Harford, Alameda, 898, 1869; Eastwood, San Francisco, 1895).

E. SEGETALIS Linn. Sp. Plant. 458. 1753. Stem leaves linear, the upper dilated at the base; glands semilunar with long spreading horns; capsules with small warts on the back; seeds deeply and finely reticulate with broad white ridges. — Occurs frequently as a ballast plant on the Atlantic coast, but not known to be established.

+– +– Perennial; root large; new growth formed from buds at the base of the old stems, which might in some cases be called perpendicular rootstocks; stems more or less woody and scaly at the base; leaves thick; capsules slightly narrowed below the apex, which contains the conical caruncles of the seeds; seeds vermiculate and shallow pitted to almost smooth. A group of closely related plants of the mountains and arid regions of the southwest; not easily separable and often passing into one another on the borders of their ranges.

++ Usually red when young; lobes usually oblong, truncate or incised; bracts mostly broad and prominent; glands large, fan shaped or truncate, crenate margined, scarcely horned; seeds usually with oblong or irregularly shaped pits.

= Stout plants; stem leaves broadest above the middle; leaves microscopically granulate.

E. LURIDA Engelm. Proc. Amer. Acad. **5**: 173. 1861; Boiss. DC. Prod. **15**^{2}: 102. 1862.

Stems several to many, 1.5 to 3 dm. high, rather strict. A few branches below the umbel; rays 12 to 20 mm. long, a few times branched; stem leaves close together, oblanceolate to obovate, sessile or subpetioled, almost always obtuse but with a small mucron, 8 to 15 mm. long, 3 to 5 mm. wide; umbel leaves wider; floral leaves rotund to oblanceolate, more or less cuneate at base, mucronate; involucres 2 mm. long and slightly narrower, more or less hirsute inside; lobes triangular ovate, hirsute; glands transversely oblong, variable in shape, usually truncate, 1 to 2 mm. long, .5 to 1 mm. wide, short stipitate; fifth gland replaced by a lobe similar to the other lobes but smaller; bracts 5 or more, large, lacerate or entire, hirsute, attached to the side of the involucre below; stamens many; capsule 3 mm. in diameter, slightly wrinkled; pedicel 5 to 8 mm. long; styles .5 mm. long, united at the base, bifid above; stigmas capitate; seeds cylindrical ovoid, flattened at the ends, 2.4 mm. long, 1.8 mm. wide, 1.4 mm. thick, prominently pitted, the pits tending to be circular and in rows; caruncle small, conical, chalazal space large and depressed, raphe prominent. — Mountains of Arizona and adjacent parts of Utah and New Mexico. — Plate 38.

Specimens examined from New Mexico (Wooton, Horse Camp, 350, 1892; Palmer, 57, 1869; Vasey, Santa Magdalena Mts., 23, 1881); Utah (Palmer, St. George, 441, 1877, with long stems covered with small obovate, obtuse leaves; Parry, 1874); Arizona (Palmer, 512, in part, 1876; Newberry, near Leroux Spring, 1858: Anderson, Bill Williams Mt., 1864).

Var. PRINGLEI (Engelm.) n. comb. *E. Pringlei* Engelm. Patterson, Check-list 115. 1887. (name only). *E. montana* Rose, Contr. Nat. Herb. **1**: 125. 1891.

Umbel more branched, the branches spreading; stem leaves oblanceolate spatulate, usually acute, 10 to 25 mm. long, 3 to 6 mm. wide; petioles very short to 2 mm. long; floral leaves rhombic ovate, 8 to 12 mm. wide, 6 to 10 mm.

long, often pubescent; involucres 2 to 3 mm. high; glands larger; styles longer, and more united; capsules 4 to 5 mm. in diameter; seeds larger, some as much as 3.2 mm. long. — Mountains of Arizona. — Plate 39.

Specimens examined (Pringle, Santa Rita Mts., 138 in Engelm. herb., 1881; Palmer, Ft. Huachuca, 455, 1890; Wilcox Ft. Huachuca, ?88, 162, 1894; Rusby San Francisco Mts., 382, 1881; Pringle, 1884; Toumey, Copper Basin, 251a, 1892, pubescent and leaves obtuse, near *E. subpubens*.

E. PALMERI Engelm. in Watson, Bot. California 2:75. 1880.

Many stemmed, 8 to 11 inches high, 3 mm. thick, glaucous, erect; rays 4 to 5, 3 to 5 cm. long, 2 to 3 times branched, a few branches below the umbel; sterile branches from the base small and few; stem leaves oblong obovate, 7 to 17 mm. long, 3 to 10 mm. wide, or the lower ones sometimes smaller, and oblanceolate and acute as on the sterile branches, close together and passing into scales below, 3 to 15 mm. apart above; umbel leaves broadly ovate, shorter and 10 to 15 mm. wide; floral leaves broader to subreniform, apiculate, sometimes slightly erose on the apical margin and sometimes subconnate; involucre whitish, 3 mm. high, slightly narrower, hirsute about the mouth inside, lobes hirsute or ciliate; glands broad ovate, truncate, yellowish brown, punctate, usually short stipitate and turned up at the inner edge; bracts more or less lobed, hirsute above, adnate to the involucre below; stamens about 15; calyx a distinct disc; styles, 1 to 1.5 mm. long, the basal third united, bifid above; stigmas capitate; capsule 5 mm. high, 5.5 mm. wide, cocci rounded, sulci very shallow; seeds ovoid, 2.5 mm. long, 1.5 mm. wide. — Mountains of southern California and extending into Lower California. — Plate 40.

Specimens examined from California (Palmer, Talley's Ranch, Cuyamaca Mts., 450, 1875; Parish, San Bernardino Mts., 444, 1881, 3068, 1894, 3727, 1895, 1880, 1882, near Mexican boundary, 1880, a low form, Long Point, 2457, 1890; Wright, San Bernardino Mts., 1881; Vasey, San Bernardino Mts., 572, 1880; Hasse, San Jacinto Mts., 1892; Orcutt, Smith

Mts., 1882; Cleveland, Laguna, 1885; Parry & Lemmon, 378, 1876); Lower California (Brandegee, San Pedro Martii, 1893; ?Orcutt, Hansen's Ranch, 1883).

Var. PEPLOFOLIA (Engelm.) n. comb. *E. peplofolia* Engelm., in Patterson, Check-list 114. 1887. (name only).

Leaves broader, more rotund; glands small, narrow. — Western Arizona.

Specimens examined (Palmer, Trumbull, 440, Flagstaff, 3970, 1884; Knowlton, San Francisco Mts., 15, 1889; Toumey, San Francisco Mts., 251b, 1892; ? Mearns, San Francisco Mts., 13, 1887, near *E. schizoloba;* Jones, Flagstaff, 3790, 1884).

E. SUBPUBENS Engelm. in Watson, Bot. Calif. **2**: 76. 1880.

Stems several, branching below ground, 1.5 to 2.5 dm. high, a few branches below the much branched umbel, whole plant covered with a fine close pubescence of spreading or crisped short hairs; leaves imbricated when young, obovate rotund, emarginate, sessile or short petioled above, spreading, 3 to 10 mm. long, 2 to 10 mm. wide; umbel leaves irregularly rotund, veins prominent below, floral leaves broad cordate reniform, 10 to 12 mm. wide, 8 to 9 mm. long; involucres 3 to 4 mm. long and wide, whitish, pubescent inside; lobes ovate triangular or truncate, dentate or divided at the apex, ciliate; glands broadly fan-shaped, with many teeth along the margin, dark colored when young, subpeltate, turned upward at the inner edge, 2 to 2.5 mm. wide, 2 mm. long, the fifth gland replaced by one or two small lobes; bracts large, pubescent, lobed or divided, sometimes glandular at the apex; stamens 15 to 20; styles 1 mm. long, united at the base, deeply bifid above; perfect capsules and seeds not seen. — Between *E. Palmeri* and *E. schizoloba.* Central Arizona. — Plate 41.

Specimens examined (Palmer, Prescott, 512 in part, 1876, near *E. Palmeri;* Pringle, Santa Catalina Mts., 1882; Rusby, Flagstaff and Lynx Creek, 1883.

= = Stem leaves elliptical lanceolate, smooth or pubescent; stems slender and often sinuous.

E. SCHIZOLOBA Engelm. Proc. Am. Acad. **5**: 173. 1861; Boiss. DC. Prod. **15**^{2}: 148. 1862. *E. incisa* Engelm. Ives, Rept. on Colorado River of the West **4**: 27. 1861; Watson, Bot. Calif. **2**: 75. 1880.

Stems slender, ascending or erect, sometimes sinuous, 1.5 to 3.5 dm. high, many branches at the base, glaucous green, sterile or fertile branches below the umbel occasional; umbel 3 or sometimes 4-rayed; rays 1.5 to 2.5 cm. long, 2 to 3 times dichotomously branched; stem leaves broad oblanceolate below to ovate above, with petioles 1 to 3 mm. long, entire, smooth or pubescent with short hairs, spreading, 4 to 9 mm. wide, 10 to 14 mm. long; umbel leaves wider, ovate to broad subcordate, or the base truncate; floral leaves broad ovate, mucronate, the base truncate, pubescent above or only at the base, 6 to 10 mm. wide, 4 to 8 mm. long; involucres large, whitish, 3 or more mm. high, 2 mm. wide, almost smooth to very pubescent inside; lobes .5 to 1 mm. long, lobed, dentate and often glandular at the apex; glands semicircular, truncate, irregularly dentate or short horned, stipitate, 1.5 to 2 mm. wide, over 1 mm. long, in dried plants dark brown when young, brownish yellow when older; bracts slender, entire or divided at the apex, usually attached to the involucre at the base; stamens many; capsule oblong ovoid, cocci rotund, sulci deep, 4 mm. wide, 5 mm. high; styles 1 mm. long, short bifid at apex, almost free at base, short clavate stigmatose, seeds oblong cylindrical, irregularly shallow pitted, 2 to 2.5 mm. long, 1.5 mm. wide; caruncle small, conical, one-half as broad as the seed. — Desert regions of southeast California and Arizona. — Plate 42.

Specimens examined from California (Jones, Panamint Cañon, 1897; Coville & Funston, Panamint Mts., 629, 1891, low and much branched); Arizona (Jones, Hackberry, 4728, 1884; Newberry, Railroad Pass, Long Valley, 1899; Smart, Massatzal Mts., 160, 1867).

Var. MOLLIS (Engelm.) n. comb. *E. mollis* Engelm. (name only) in Patterson, Check-list 114. 1887. (not Gmelin).

Whole plant very pubescent with short, spreading hairs; leaves larger, and those of the inflorescence more tapering toward the base. — Arizona. — Plate 43.

Specimens examined (Pringle, 20, 132, 1881, Santa Catalina Mts.; Toumey, Huachuca Mts., 1894; Prim, 1892, Sabine Cañon, 1892; Palmer, Cottonwood Creek, 511, 1876; Lemmon, Santa Catalina Mts., 1880, Rucker Valley, 1881).

↔ ↔ Glands smaller, crescent shaped, bicornute, usually only slightly toothed between the horns; lobes triangular, rarely truncate; bracts mostly small and filiform; seeds with more rotund shallow pits.

E. MONTANA Engelm. Mex. Bound. **2**[1]: 192. 1859; Boiss. DC. Prod. **15**[2]: 148. 1862; Coulter, Bot. West. Tex. 394. 1894. *E. montana gracilior* Engelm. l. c. (in part). *E. Fendleri* Kl. & Gar. Abhandl. Königl. Akad. Berl. **1859**: 85. 1860.

Stems few, slender, 1.5 to 3.5 dm. high, slightly woody below, a few branches at the base and below the umbel; rays 3, 1.5 to 3.5 cm. long, 4 or more times branched; stem leaves rotund to oblong or lanceolate, acute or obtuse, short petioled, spreading or deflexed, 5 to 20 mm. long, 3 to 7 mm. wide; umbel leaves broader, ovate or even cordate; floral leaves broad ovate or cordate, sometimes subpandurate, 8 to 11 mm. wide, 7 to 9 mm. long, glabrous or pubescent; involucres 2 mm. high, turbinate to subglobose, a few hairs on the inside; lobes entire or dentate, pubescent; glands short bicornute, .5 mm. long, 1 mm. wide, short stipitate; bracts short, filiform, almost smooth; capsule depressed ovoid, 3 mm. high, 3.5 mm. wide; styles 1 mm. long, united at the base, short bifid at the apex; stigmas short clavate; seeds ovoid oblong, 2 mm. long, 1.4 mm. wide, ash-colored, deeply and somewhat irregularly pitted; raphe, caruncular space and chalaza sunken; caruncle large, conical, stipitate. — Southern Utah and Colorado and south into Mexico, in the mountains. — Plate 44.

A very variable species, connecting with *E. robusta* by the forms nearest the type specimen (Fendler, 786), and by the variety with *E. odontadenia* and *E. schizoloba;* also by the Texan forms of that species with *E. brachycera*. *E. brachycera* and *E. odontadenia* are scarcely more than subspecies of this.

Specimens examined from New Mexico (Fendler, Santa Fé Creek, 786, 1847; Bigelow, near El Paso, 1282a; Wooton, White Mts., 614, 1897, very slender and tall); Arizona (Pringle, Huachuca Mts., 1889, pubescent, near *E. odontadenia*); Texas (Nealley, Limpia Cañon, 613 = 446, 1889); Mexico (? Mearns, San Luis Mts., 155, 1892).

Var. TRIFARIS n. var.

Stems few to very many, low, 1 to 2.5 dm. high, more slender and sinuous, usually pubescent throughout, little branched; leaves broader, more triangular ovate; involucre as in *E. odontadenia;* seeds and capsule not seen. — Range of the species. — Plate 45.

Specimens examined (Thurber, El Paso, Texas, 160, 1851; Bishop, S. Utah, 1872-4; Eastwood, Navajo Cañon, 1892, pubescent, close to Fendler, 786).

E. ODONTADENIA Boiss. DC. Prod. 15^2: 148. 1862. *E. montana* Engelm. Mex. Bound. 2^1: 192. 1859. (in part).

Stems many, slender and sinuous, 1.5 to 2 dm. high; rays 3 or sometimes 2 or the stem terminated by a single involucre; rays with few branches; stem leaves numerous, oblanceolate to ovate lanceolate, acute, short petioled, 7 to 15 mm. long, 2 to 5 mm. wide; umbel leaves broad ovate, acuminate or acute; floral leaves rhombic circular, 4 to 5 mm. in diameter; involucres broad turbinate, pubescent, 2 mm. high, 2.5 mm. wide; glands ascending, triangular semilunate, dentate between the diverging horns, 1 mm. wide, .7 mm. long; bracts small; seeds oblong, with a prominent, conical caruncle almost half as long as the seed; otherwise as in *E. montana*. — Mountains near El Paso, Tex. — Plate 45.

Specimens examined (Wright, El Paso, 1825, 1851-2; Wright, 661, 1849, Tex.?).

E. BRACHYCERA Engelm. Mex. Bound. **2**[1]: 192. 1859; Boiss. DC. Prod. **15**[2]: 147. 1862. *E. chamaesula* Coulter, Contr. Nat. Herb. **1**: 48. 1890. *E. campestris* Coulter, l. c.; Heller, Bot. Expl. South. Tex. 60. 1895.

Stems few, 2 to 3.5 dm. high, woody below, leaf scars not prominent, a few branches below the umbel; rays 3 or sometimes 5, 15 to 20 mm. long, many times dichotomous; stem leaves oblong linear, acute or obtuse, sessile or short petioled, 8 to 15 mm. long, 2 to 3 mm. wide; umbel leaves ovate to lanceolate, 4 to 10 mm. wide; floral leaves rhombic or triangular ovate, broadly cuneate to subcordate at base, obtuse, mucronate, 5 to 8 mm. in diameter; involucre 1.5 to 2 mm. high, 1 mm. wide, or more, hirsute inside and on the lobes; glands triangular ovate, crenulate between the short horns; capsule 3.5 to 4 mm. long and wide, depressed ovoid; cocci rounded; sulci shallow; seeds ovoid oblong, covered with rather large, distinct pits, ash colored, darker in the pits, 1.8 to 2 mm. long, 1.3 to 1.4 mm. wide; caruncle large, broad conical, nearly one-half as long as the seed. — Eastern New Mexico and western Texas and in Mexico. The Texas specimens are close to *E. chamaesula* and *E. montana*. — Plate 46.

Specimens examined from New Mexico (Wright, Doñana, 1821, 1851–2); Texas (Nealley, Chanates Mts., 575 = 441, 1889, pubescent, Limpia Cañon, 614 = 440, 1889; Reverchon, Upper Llano, 1593, 140, 1885; Heller, Kerrville, 1599, 1894); Mexico (Pringle, Potrero Peak, Chihuahua, 1143, 1886).

E. CHAMAESULA Boiss. Cent. Euph. 38. 1860; Boiss. DC. Prod. **15**[2]: 162. 1862. *E. esulaeformis* Engelm. Mex. Bound. **2**[1]: 192. 1859. *E. campestris esulaeformis* Boiss. DC. Prod. **15**[2]: 147. 1862. (in part). *E. campestris* Engelm. Euph. Wheeler Exped. 248. 1878.

Stems one to several, 4 to 5 dm. high, rather thick, leaf scars not prominent on the woody base, glaucous, smooth, a number of fruiting or barren branches above the middle of the stem; umbel 3 to 6-rayed; rays 4 to 5 cm. long, 3 or 4 times branched; stem leaves spreading,

short elliptical below to oblong above, smooth, obtuse or occasionally acute, somewhat fleshy, mucronate, erose denticulate, especially above, or entire, 4 to 6 mm. wide, 8 to 20 mm. long, very short petioled, those on sterile branches crowded, oblong linear, more blunt at apex; umbel leaves ovate lanceolate, cordate, 10 mm. wide, 20 mm. long, or less, reflexed or spreading; floral leaves broadly ovate, usually cordate, subpandurate, mucronate, sometimes slightly pubescent, 9 to 13 mm. wide, 11 to 14 mm. long; involucre 3 mm. high, 2 to 3 mm. wide, hirsute inside on the lobes and below the glands; lobes obtuse or truncate; glands short stipitate, yellowish brown, semicircular, with horns of varying length usually incurved, often long dentate between; bracts broader than in related species, lacerate; stamens large and numerous, anthers conspicuous at time of flowering; capsule depressed ovoid, subcordate at base, distinctly narrowed below the apex, 5 mm. long, 6 mm. wide; sulci broad and obtuse; styles 1.5 to 2 mm. long, united about half their length, stigmas large, clavate, recurved more than usual; seeds oblong conical, truncate at both ends, the base very broad and flat, greenish gray to dark brown, covered with large very shallow pits to almost smooth, 2.6 to 3.5 mm. long, 2.2 to 2.8 mm. wide; caruncle conical.— Southern Arizona and New Mexico and northern Mexico. — Often proliferous or producing foliage shoots from the umbel. — Plate 47.

Specimens examined from New Mexico (Wright, Copper Mines, 1820, 1851, a small piece in Dr. Millspaugh's herbarium from Boissier's herbarium, is certainly the same as the specimens of this number in American herbaria, the seeds are not quite smooth; Greene, Silver City, 123, 1880; Rusby, Bear Mts., 381, 1881); Arizona (Toumey, Chiricahua Mts., 6, 1894; Wilcox, Ft. Huachuca, 1891, 1893; Wheeler, 1871–72, or from Nevada?; Toumey, Flagstaff, 252, 1892; Nealley, Rincon Mts., 141, 1891; Palmer, Bill Williams Mt., 1869; Rothrock, Willow Springs, 213, 1874; Lemmon, Huachuca Mts., 1882, a slender form; Pringle, Huachuca Mts., 1884, Santa Rita Mts., 1881, some of the specimens are pubescent, slender, and smaller seeded; Rusby, Mogollon Mts., 378, 1881; Buckminster, approaching *E. campestris*); Mexico (Hartman, 762, 1891; Smith, San Luis Mts.).

Var. SUBDENTATA (Engelm.) n. comb. *E. esulaeformis subdentata* Engelm. Mex. Bound. 2^1: 192. 1859.

Leaves, especially the upper, prominently dentate or serrate. — Northern Mexico, and may be found in Arizona. — Plate 47.

Specimens examined (Hartman, San Diego, Chihuahua, 669, 1891; Smith, San Luis Mts.; Parry, San Francisco Spring, 1852.

E. CAMPESTRIS Cham. & Schlecht. Linnaea **5**: 84. 1830; Boiss. DC. Prod. $\mathbf{15}^2$: 146. 1862. *E. esulaeformis* Schauer, Linnaea **20**: 729. 1847. *Tithymalus esulaeformis* Kl. & Gar. Tricoc. 84. 1860. *T. campester* Kl. & Gar. l. c. 86. — Millspaugh, Bot. Gaz. **25**: 25. 1898. *f.*

Stems woody, branching in the lower part, 2 to 4 dm. high, rather slender and wiry, glaucous, reddish, the lower part covered with the prominent leaf scars; umbel 5-rayed; rays 1 to 1.5 cm. long, several times short dichotomous; leaves crowded, usually ascending, linear to oblanceolate, acute, mucronate, entire, some subpetioled, those on the sterile branches smaller and narrower; umbel leaves obovate to ovate, acute; floral leaves nearly rotund to ovate lanceolate, or sometimes obovate, mucronate, subconnate, 3 to 6 mm. wide, 4 to 10 mm. long; involucres 1 to 2.5 mm. wide, 2 to 3 mm. high, hirsute inside; lobes oblong triangular, acute or bidentate, erect or slightly incurved, hirsute; glands semilunar, entire or slightly toothed between the short often incurved horns, .5 to .8 mm. long, .8 to 1.5 mm. broad, the horns about as long; bracts attached to the involucre below, linear lanceolate, hirsute all over; pedicels of staminate flowers pubescent; capsule ovoid globose, slightly depressed, smooth, 3.5 mm. wide, 3 mm. high; cocci rounded, with a prominent line on the back; sulci shallow, obtuse; pedicel 5 mm. long; styles 1 mm. long, more or less united above the base, short bifid, stigmas clavate thickened; seeds ellipsoid, subangular in cross section, slightly flattened, covered with

broad irregular flat ridges or broad shallow pits, gray, the ridges usually white, 2.2 to 2.4 mm. long, 1.2 to 1.7 mm. wide, raphe sunken, a rather acute ridge on the back; chalazal space deep; caruncle depressed conical. — Eastern, central, and southern Mexico. The two specimens from Texas referred here are too near *E. brachycera*. — Plate 48.

Specimens examined from Mexico (Gregg, San Antonio, 351, 1848–49, Saltillo, 426, 1848–9, Real del Monte, 643, 1849; Palmer, Durango, 72, 1896, Coahuila, 1226-27-28, 1880, Saltillo, 1225, 2054, 1880; Parry & Palmer, San Luis Potosi, 803, 1878; Halm, 1868; Ghiesbreght, Chiapas, 734, 1864–70, a form; Hartweg, 31, 1857; Ascherborn, from the type of *E. csulaeformis;* Halstead, Volcan. de Pizzaro; Schiede, 38; Seaton, Mt. Orizaba, 224, 1891; J. D. Smith, Guatemala, 3476, 1892; Nelson, Oaxaca, 1361, 1894; Duges, Guanajuata, 1880, 1883; Graham, Herb. J. S. Mill; Schaffner, Vallée de Mexico, 1875, San Luis Potosi, 1864, 1866, 1876); Texas (Wright, Nueces, 1404, Rio Grande, 1848).

E. ROBUSTA (Engelm.) Small in Brit. & Brown, Ill. Flora **2**: 381. 1897. *E. montana robusta* Engelm. Mex. Bound. **2**[1]: 192. 1859. *E. montana* Boiss. DC. Prod. **15**[2]: 148. 1862. (in part); Coulter, Man. 327. 1885; and most authors. — Brit. & Brown, Ill. Flora. *f. 2338.*

Stems many, stout, 1 to 3 dm. high, covered at the base below ground with broad ovate membranaceous scales, many large spreading branches below the 3 to 5-rayed umbel, smooth or occasionally pubescent especially at the base of the floral leaves; rays short, many times dichotomous; sterile branches with smaller and narrow lanceolate oblong leaves usually present; stem leaves oblong to ovate cordate, usually sessile, 10 mm. wide, 12 mm. long; floral leaves broadly ovate to cordate, 10 to 15 mm. wide, 10 to 12 mm. long; involucres 2.5 mm. high, 1.5 mm. wide, hirsute inside; lobes triangular or lanceolate triangular, hirsute, sometimes bidentate at the apex; glands semilunate, short horned and sometimes dentate between the horns, 1 to 2 mm. wide, 1 mm. or less long; fifth gland replaced by a lobe shorter than the other lobes; bracts short, narrow, pubescent; stamens several, their pedicels

sometimes pubescent; capsule depressed ovoid, smooth, deeply sulcate, 4 to 4.5 mm. wide and high; pedicel 4 to 5 mm. long or longer; styles united below, deeply bifid; stigmas clavate; seeds ovoid, somewhat flattened at the lower end, covered with very shallow, circular, or irregular pits, sometimes almost smooth, usually white, 2.3 mm. long, 1.6 mm. wide, caruncle low conical. — In the Eastern Rocky Mountains, Colorado to Montana. Northward the plants are more dense, more scaly at the base and the leaves broader. Southward they are more slender, less branched, and the leaves narrow elliptical ovate, connecting with *E. montana*. — Plate 49.

Specimens examined from Colorado (? James, Long's Exped.; Vasey, 518, 1868; Parry, 438, 1862; Hall & Harbour, 509, 1862; Trelease, Ute Pass, Georgetown, 1886; Gurney, 1890; Mulford, Colorado Springs, 1892; Redfield, Colorado Springs, 7411, 1872; Parry, Clear Creek, 436, 1862, seeds nearly smooth; Engelmann, Idaho, 1874, Empire City, 1881; Jones, Colorado Springs, 32, 1878; Northrop, Pike's Peak, 1888; Pammel, Larimer Co.; Eastwood, Steamboat; Baker, Larimer Co., 3.5 dm. high; Snow, 3 dm. high; Wolf, 85, 1873; Patterson, Clear Creek, 132, 1885; Coulter, Denver, 1873, Clear Creek, 1872); Montana (Tweedy, Livingston, 1889; Blankinship, 44, 1890; Ward, Glendive, 1883); Nebraska (Webber, Pine Ridge, 1889; Williams, Pine Ridge, 1890; Rydberg, McColligan Cañon, 362, 1891); South Dakota (Rydberg, Hot Springs, 997, 1892; Forwood, Black Hills, 1887); Wyoming (Nelson, Whalen Cañon, 529, 1894; Hayden, 1860); early northern collections (Mersch, North Platte, 1843; Nuttall; Fremont Exped., 1842).

A pubescent form is represented by Williams, Belt Mts., Montana, 357, 1886; Scribner, mouth of Shield's River, Montana, 250, 1883; Nelson, Pine Creek, Wyoming, 26, 1892; Crandall, Ft. Collins, Col., 1890.

Letterman, Colorado Springs, Col., 229, 1884; Crandall, Ft. Collins, 456, 1895; Schneck, Denver, Col., 1893; Wislizenus, between Placer, Col., and Albuquerque, N. M., 3, 1846; Sheldon, Buena Vista, Col., 579, 1892; Coulter, Denver, Col., 1873; are of the more slender southern form.

Var. INTERIORIS n. var.

Not much branched below the umbel; rays 2.5 to 4

cm. long; leaves large, usually thinner, broader; glands serrate. — West of the Rocky Mountains in Colorado, Utah, and Arizona. — Some specimens approach *E. schizoloba* and *E. Palmeri peplofolia*. — Plate 49.

Specimens examined (Watson, Wahsatch Mts., Utah, 1081, 1869; Eastwood, Mancos, Col., 1891; Johnson, South Utah, 1876; Brandegee, Cañon City, Col., 396; Jones, Cedar City, Utah, 5206, 1894; Palmer, Arizona, 1869. The last three are doubtfully placed here.

+ + Perennial by a horizontal rootstock or by buds from long, horizontal roots; umbel many-rayed; seeds smooth; introduced from Europe.

E. CYPARISSIAS Linn. Sp. Plant. 461. 1753; Boiss. DC. Prod. **15**^{2} : 160. 1862; Gray, Man. 388. 1857. [2d ed.]; Macoun, Cat. 426. 1886; Brit. & Brown, Ill. Flora **2** : 381. 1897. *Tithymalus Cyparissas* Hill, Hort. Kew. 172 (4). 1768; *T. Cyparissias* Lam. Fl. Fr. **3** : 96. 1778. (fide Index Kewensis). *T. angustifolius* Gilib. Fl. Lituan. **2** : 209. 1792. (fide Index Kewensis). *Euphorbia Esula* Tenore, Fl. Nap. **1** : 273. (fide Index Kewensis). *Esula Cyparissias* Haw. Pl. Succ. 155. 1812. *Esula cupressina* S. F. Gray, Nat. Arr. Brit. Pl. **2** : 259. 1821. *Keraselma Cyparissias* Rafin. Fl. Tell. **4** : 116. 1836. (fide Index Kewensis). *Tithymalus acicularis* Dulac, Fl. Hautes-Pyr. 156. 1867. (fide Index Kewensis). *Euphorbion cyparissium* St. Lager, Ann. Soc. Bot. Lyon **7** : 126. 1880. *E. capparis* Hyams, Journ. Elisha Mitchell Soc. **1884–5** : 75. 1885. *Esula pensylvanica* Gandoger, Fl. Eur. **20** : 107. 1890. — Reichenb. Ic. Fl. Germ. *f. 4793;* Brit. & Brown, Ill. Flora *f. 2337;* Pammel, Seedcoats *pl. 12. f. 18c.*

Long horizontal roots covered with adventitious buds; stems several to many, 8 to 13 cm. high, bright green, glaucous, somewhat striate; umbel about 15-rayed; rays 1 to 2 cm. long, slender, 2 to 3 times dichotomous; branches below the umbel mostly sterile, after fruiting time much

elongated beyond the primary umbel; stems covered below with ovate, acute, imbricated scales which pass into crowded, linear, entire, obtuse leaves; middle stem leaves 1 to 3 cm. long, 1.5 to 3 mm. wide, tapering at the base, margins often revolute, some of the upper dilated at the base; leaves of sterile branches narrower, acute; umbel leaves linear lanceolate, shorter, dilated at the base; floral leaves broadly ovate, obtuse, light colored when young, subpandurate, 8 mm. broad, 6 mm. long, nerves prominent; involucres 1.5 mm. high; lobes ovate, rounded truncate, ciliate with short hairs, a few short hairs beneath the glands inside; glands semilunate, with short diverging horns, less than 1 mm. wide, somewhat declined, bright golden brown when dry; the fifth gland replaced by a small, acute lobe; bracts none or very small; stamens several; capsule erect, its pedicel very short, depressed globose, 3.5 mm. wide, 3 mm. high; cocci rounded, with short warts on the back; sulci obtuse; styles .7 to 1 mm. long, united more than half their length, bifid above; stigmas almost capitate, recurved; seeds ellipsoid, very slightly flattened, 1.7 to 1.9 mm. long, 1.3 to 1.4 mm. wide, brownish gray; chalazal depression shallow, circular; raphe a brown colored line; caruncle thin, flat or saddle shaped. — A weed naturalized from Europe in the northeastern United States and lower Canada from Nova Scotia to Delaware, west to northern Michigan and Kansas, one specimen from Colorado. Rarely producing seed in this country. — Plate 50.

Specimens examined from Maine (Redfield, Mt. Desert Island, 16528, 1890; Gayle, Cape Elizabeth, 701, 1895); Massachusetts (Fritchey, Provincetown, 1889; Redfield, Pittsfield, 7369, 1874; Whitfield, Mt. Washington, 1889; Waverly, 1895; Boott, Boston, 1866); Michigan (Trelease); Iowa (Reppert, Muscatine, 127; Arthur, 710, 1875; Rolfs, Boone Co., 1891; Hitchcock, Iowa City; Fink, Fayette Co., 123, 1894); New York (Brown, Staten Island, 1879; Millspaugh, Binghamton, 1882, Broom Co., 1885, Tioga Co.; Curtiss, Oswego, 1866; Kerr, Staten Island, 1895; Trelease, Ithaca, 1878); Colorado (Cowen, Ft. Collins, 452, 1895); Kansas (Manhattan, various collectors, 1890–96); Missouri (Bush, Jackson Co., 1888); Pennsylvania (Small, Lancaster, 1889, 1891; Porter, Easton, 1869; Heller, Lancaster, 1891; Curwen, Warren, 1895); New Jersey (Shuh, Franklin,

1887; New Market, 1892; Stowell, Hammonton, 1891); New Hampshire (Robinson, Jaffrey, 221, 1897); Connecticut (Eaton, New Haven, 1858; Eames, Bridgeport, 1893; Pollard, Green's Farms, 1894); Vermont (Stevens, Lake Willoughby, 1895; Kent, E. Wallingford, 1897; Hinsdale, St. George, 1892; Ruggles, Hartland); Wisconsin (Kellogg, 1888); Ohio (Kellerman, Newport, 1897; Jaske, Dayton, 1895; Wilkinson, 1892); Ontario (Burgess, London, 1891); Kentucky (Kate Palmer, Louisville, 1888).

Also reported from New Brunswick and Nova Scotia (Macoun, Cat. Can. Plants 426).

E. Esula Linn. Sp. Plant. 461. 1753; Gray, Man. 405. 1848; Brit. & Brown, Ill. Flora **2**: 380. 1897; Boiss. DC. Prod. **15**^{2}: 160. 1862. *Tithymalus Esula* Hill, Hort. Kew. 172 (4). 1768; Scop. Fl. Carn. **1**: 338. 1772. [2d ed.]. *T. linifolius* Lam. Fl. Fr. **3**: 95. 1778. (fide Index Kewensis). *Euphorbia tristis* Besser, Index Hort. Crem. Suppl. 4: 27. 1811. (fide Boiss. DC. Prod.). *Esula Dalechampii* Haw. Pl. Suc. 155. 1812. *? Euphorbia salicifolia* DC. Fl. Fr. **6**: 362. 1815. *E. angustifolia* Sweet, Hort. Brit. 357. 1827. (fide Index Kewensis). *? E. racemosa* Tsch. in Reichenb. Fl. Germ. Excurs. 761. 1832. *Keraselma Esula* Rafin. Fl. Tell. **4**: 116. 1836. (fide Index Kewensis). *Euphorbia discolor* Ledeb. Fl. Ross. **3**: 577. 1846–51. *E. Fleuroti*, *E. riparia*, *E. Loreyi*, *E. ararica* Jord. Billot. Annot. Fl. Fran. et Allem. 27. 1855. (fide Boiss. in DC. Prod.). *E. intermedia* Bréb. Fl. Normand. 271. 1859. [3d ed.]. *Tithymalus discolor* Kl. & Gar. Tricoc. 97. 1860. *T. tristis* Kl. & Gar. l. c. 92. *Euphorbion Esulum* St. Lag. Ann. Soc. Bot. Lyon **7**: 125. 1880. — Reichenb. Ic. Fl. Germ. *f. 4791;* Brit. & Brown, Ill. Flora *f. 2335;* Pammel, Seed-coats *pl. 12. f. 18b.*

Stems about 4 cm. high, striate, many branches below the 8 or 9-rayed umbel, the lower sterile; rays about 3 times dichotomous, leaves crowded below and more or less scale-like; middle stem leaves 4 to 8 mm. wide, 3 to 6 cm.

long, tapering to the base, but sessile, linear oblong or lance-linear, sometimes oblanceolate, ascending or spreading, smooth, entire, acute, mucronate, with an evident marginal line, those on sterile branches smaller, 2 to 2.5 cm. long, obtuse or acutish; umbel leaves lanceolate, 2 to 3 cm. long; floral leaves broadly ovate, 14 to 16 mm. wide, 10 to 13 mm. long; involucres 1.5 mm. high, 1 mm. wide, lobes ovate, truncate, projecting beyond the glands, erect, a few hairs on the edge and under the glands inside; glands semilunar, dark colored, 1 mm. wide, 5 mm. long, slightly declined, horns short, diverging; bracts one-half as long as the involucre, filiform; stamens many; capsule depressed ovoid, 4.5 to 5 mm. wide, 3.5 mm. high; cocci rounded, roughened on the back with small ridges and papillae; sulci deep, obtuse; styles 2 to 2.5 mm. long, united about one-third of their length, bifid above, recurved, clavate stigmatose; seeds ellipsoid ovoid, circular in cross section, 1.5 mm. in diameter, 2 mm. long; chalazal space shallow; caruncle thin, flat, orbicular. — Naturalized from Europe in a few places in the northeastern United States. — Plate 51.

Specimens examined from Massachusetts (Oakes, Ipswich, Newbury, 1827, Essex Co., 1842); Maine (Parlin, Berwick, 1894); New York (Dudley, Groton, 797, 1895).

Also reported from Niagara and Attica, N. Y. (Day, Fl. Buffalo 67, 1883); Indiana (Schneck, 7th Ann. Rept. Geol. Surv. Ind. 558. 1876); near Lansing, Michigan (Beal, Mich. Flora 129. 1892).

E. LUCIDA Waldst. & Kit. Pl. Rar. Hung. **1**: 54. *pl. 54.* 1802. (fide Boiss. in DC. Prod. **15**^{2}: 163. 1862). *E. pallida* Willd. Sp. Plant. **2**: 923. 1799. *Galarhoeus Androsemifolius* Haw. Pl. Suc. 146. 1812. *Keraselma lucida* Rafin. Fl. Tell. **4**: 116. 1836. (fide Index Kewensis). *Euphorbia androsaemifolia* Steud. Nom. **1**: 610. 1841. [2d ed.]. *Tithymalus lucidus* Kl. & Gar. Tricoc. 89. 1860. *Euphorbia virgata* Noe in Nyman's Conspect. 652. 1881. *E. oleaefolia* Noe, l. c. *E. Nicaeensis* Millspaugh(?), Bull. Torr. Bot.

Club **14**: 24. 1887; Watson, Gray, Man. 456. 1890. [6th ed.]. Millspaugh, Medic. Plants **2**: 150. 1892; Brit. & Brown, Ill. Flora **2**: 380. 1897. — Reichenb. Ic. Flora Germ. *f. 4797;* Millspaugh, *pl. 150.* (distributed in herbaria); Brit. & Brown, Ill. Flora *f. 2336.*

Stems 6 to 12 dm. high, 5 to 10 mm. thick, striate; umbel about 12-rayed; rays 3 to 4.5 cm. long, 2 to 3 times dichotomous; many similar branches below the umbel; leaves crowded below, the lower scale like, those on the middle of the stem oblong lanceolate, smooth, shining, truncate or cordate at base, sessile or short petioled, obtuse or acutish, mucronate, reflexed, 6 to 10 cm. long, 2.5 cm. wide, pinnately veined, margin entire, subrevolute; leaves on sterile branches smaller, 2.5 to 3 cm. long; umbel leaves lanceolate with a cordate base, to cordate; floral leaves broad ovate cordate, mucronate, 15 to 17 mm. wide, 10 to 12 mm. long, yellow at time of flowering; involucres 2.3 mm. high, 2.5 to 3 mm. broad, white membranaceous, pubescent with short hairs beneath the glands inside; lobes oblong, truncate, ciliate, erect; glands transversely ovate, margin truncate or undulate, 1 to 2 mm. wide, 1 mm. long, yellow, horns .5 mm. long; bracts filiform, almost as long as the involucre, a few hairs at the apex; stamens many; capsule ovoid, punctate scabrous; styles 2 mm. long, united one-third of their length, bifid one-third; stigmas clavate, recurved; seeds ovoid oblong, gray; caruncle oblong, flattened. — Introduced from Europe into central New York. *E. Nicaeensis*, with which this has been confused, has short fleshy, trinerved leaves. Like *E. Cyparissias*, it seems, this plant rarely if ever produces seed in this country, but, no doubt, spreads extensively by the long roots or rhizomes. Underground parts, mature capsules and seeds not seen. — Plate 52.

Specimens examined from New York (Millspaugh, Vestal, 1885, 1886, Waverly, 1888; Clute, Vestal, 1896, Binghamton, 1896; Curtice, Moravia); Pennsylvania (Clute, Susquehanna Co., 1896).

E. PARALIAS Linn., with crowded lanceolate, sessile, fleshy leaves, is said to occur as a ballast plant at Girard Point, Philadelphia, Penn. (Burk, Proc. Acad. Sci. Phil. **1877**: 108).

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EXPLANATION OF PLATES.

The habit drawings, except in plates 48, 51 and 52, drawn by the author, were made from herbarium specimens by Mrs. Grace Johnson Vieh under the supervision of the author. The details were drawn by the author, in most cases with a camera lucida, and will show the most important characters of each species. Unless otherwise indicated the details are enlarged five diameters, except those of the seeds, which are enlarged eight diameters. The habit drawings are reduced one-half.

Plate 11, *E. Lathyris*.— 1, Involucre, glands, and staminate pedicels and bracts; 2, ventral view of seed; 3, lateral view of caruncle.

Plate 12, *E. Floridana.* Staminate and pistillate plants. — 1, Portion of involucre; 2, group of stamens and bract; 3, lobe and bract; 4, rudimentary staminate and pistillate flowers; 5, young pistillate flower; 6, cocci; 7, 8, seeds.

Plate 13, *E. inundata.* Staminate and pistillate plants. — 1, 2, Involucres and glands; 3, staminate flowers and bract; 4, lobe, × 5, margin of lobe and bract, much enlarged; 5, portion of capsule; 6, seeds.

Plate 14, *E. telephoides.* — 1, Portion of involucre and glands; 2, involucre with young capsule.

Plate 15, *E. Darlingtonii.* — 1, Hairs from leaf, much enlarged; 2, involucre, lobe, and gland; 3, staminate flower and bracts; 4, 5, seeds.

Plate 16, *E. platyphylla.* — 1, Involucre and gland; 2, lobe and bract, much enlarged; 3, staminate flower and bract; 4, old involucre with capsule; 5, capsule; 6, seeds.

Plate 17, *E. obtusata.* — 1, Involucre, staminate flower and bract; 2, lobes and sinus, much enlarged; 3, involucre; 4, capsule and styles; 5, seeds.

Plate 18, *E. Arkansana.* — 1, Leaves; 2, involucre; 3, 4, lobes and bracts, much enlarged; 5, involucre and capsules; 6, capsule, staminate pedicel, and bract; 7, seed. Var. *Missouriensis.* — 8, Upper part of plant; 9, leaves and seed.

Plate 19, *E. Arkansana.* — 1, Southern Texas form (Heller, 1475); 2–6, var. *Coloradensis.* — 2, plant; 3, 4, leaves and capsule from Watson, Antelope Island, Utah; 5, 6, leaf and capsule from Vasey, Colorado, 1868.

Plate 20, *E. Arkansana atrosemina.* — 1, Floral leaf; 2, lobes, sinus, and gland, much enlarged; 3, bract, much enlarged, and capsule; 4, seeds.

Plate 21, *E. Mexicana.* — 1, Leaves; 2, involucre; 3, bract, glands, and lobes, much enlarged; 4, capsules; 5, seeds.

Plate 22, *E. dictyosperma.* — 1, Leaves; 2, involucres, staminate flower and bract; 3, bracts, much enlarged; 4, lobes and sinus, much enlarged; 5, capsules; 6, seed.

Plate 23, *E. dictyosperma.* — 1, Robust form, old plant (Brewer, 1214); 2, involucre, capsule, and seed of same; 3, bracts of same, much enlarged; 4, slender form (Hort. Cantab. 1856); 5, leaf and seed of same; 6, lobe of same, much enlarged; 7, seed of Lower Californian plant.

Plate 24, *E. alta.* — 1, Involucres; 2, involucre and staminate pedicel and bract; 3, capsule; 4, branched wart of capsule, and styles; 5, seeds.

Plate 25, *E. leiococca.* — 1, Leaves; 2, involucres, staminate pedicel and bract; 3, portion of involucre, much enlarged; 4, capsules; 5, seeds.

Plate 26, *E. Helioscopia.* — 1, Leaf; 2, involucres, staminate pedicel and bract, and gland; 3, bract, much enlarged, and hair from same, still more enlarged; 4, capsule; 5, seeds.

Plate 27, *E. trichotoma.* — 1, Leaf; 2, involucre, lobe, and staminate pedicel with bracts; 3, bracts, much enlarged; 4, capsule; 5, seeds.

Plate 28, *E. exigua.* — 1, Stem leaf; 2, base of floral leaves; 3, involucre, staminate pedicel and bract, gland and lobes; 4, capsules; 5, seeds.

Plate 29, *E. Helleri.* — 1, Leaves; 2, portion of involucre, gland, and bract; 3, gland, somewhat enlarged, bract and lobe, much enlarged; 4, capsule; 5, seeds.

Plate 30, *E. Peplus.* — 1, Involucre, staminate pedicel and bract, and glands; 2, capsule; 3, seeds.

Plate 31, *E. peplidion.* — 1, Leaves; 2, involucre, staminate pedicel and bract, and glands; 3, old involucre; 4, capsule; 5, seeds.

Plate 32, *E. tetrapora.* — 1, Involucres, staminate pedicel and bract; 2, capsule; 3, seeds.

Plate 33, *E. longicruris.* — 1, Leaves; 2, portion of involucre, glands, staminate pedicel, and bracts; 3, capsule; 4, seeds.

Plate 34, *E. commutata.* — 1, Leaf; 2, glands; 3, portion of involucre with staminate pedicel and bracts; 4, capsule; 5, seeds.

Plate 35, *E. Roemeriana.* — 1, Leaf; 2, portion of involucre, staminate pedicel and bract; 3, portion of involucre and glands; 4, pistillate flower, involucre and capsule; 5, seeds.

Plate 36, *E. crenulata.* — 1, Leaf; 2, portion of involucre, lobe, gland, and bracts; 3, capsule; 4, seeds.

Plate 37, *E. crenulata Franciscana.* — 1, Involucre; 2, portion of involucre, lobe, and glands; 3, seeds.

Plate 38, *E. lurida.* — 1, Leaves; 2, glands and bracts; 3, seed.

Plate 39, *E. lurida Pringlei.* — 1, Involucre with young capsule; 2, involucre with bract, and glands; 3, staminate flowers; 4, capsule; 5, seeds.

Plate 40, *E. Palmeri.* — 1, Involucre with capsule, and gland; 2, involucres; 3, capsule; 4, seeds.

Plate 41, *E. subpubens.* — 1, Involucre and bracts; 2, involucre with young capsule.

Plate 42, *E. schizoloba.* — 1, Portions of involucres, glands, and bracts; 2, involucre; 3, capsule; 4, seed.

Plate 43, *E. schizoloba mollis.*— 1, Portion of involucre and staminate pedicel; 2, capsule; 3, seeds; 4, embryos.

Plate 44, *E. montana.*— 1, 2, Involucres; 3, capsule; 4, seeds.

Plate 45, *E. odontadenia.* — 1, Leaves; 2, involucres and glands; 3, seeds; 4, *E. montana trifaris.*

Plate 46, *E. brachycera.* — 1, Involucre, gland, and staminate flower; 2, involucre, bracts, and staminate pedicel; 3, capsule; 4, seeds; 5, branch from plant of Texan form.

Plate 47, *E. chamaesula.* — 1, Portion of involucre, bracts, gland, and stamen; 2, involucre; 3, capsule; 4, seed; 5, leaf margins; 6, leaf margin of var. *subdentata.*

Plate 48, *E. campestris.* — 1, Small floral leaf; 2, portion of involucre with bract, and staminate flower; 3, glands; 4, involucre and floral leaves; 5, capsule and old involucre; 6, seeds.

Plate 49, *E. robusta.* — 1, Involucre, staminate pedicel, bract, and gland; 2, capsule; 3, seed; 4, plant of var. *interioris.*

Plate 50, *E. Cyparissias.* — 1, Leaves; 2, scales from base of stem; 3, flowering involucre, glands, and staminate flowers; 4, capsule; 5, seeds.

Plate 51, *E. Esula.* — 1, Flowering involucre with floral leaves, and glands; 2, portion of involucre; 3, staminate flowers and bract; 4, young and old capsules; 5, seeds.

Plate 52, *E. lucida.* — 1, Tips of leaves; 2, involucre and bract; 3, involucres and floral leaves; 4, stamens and glands.

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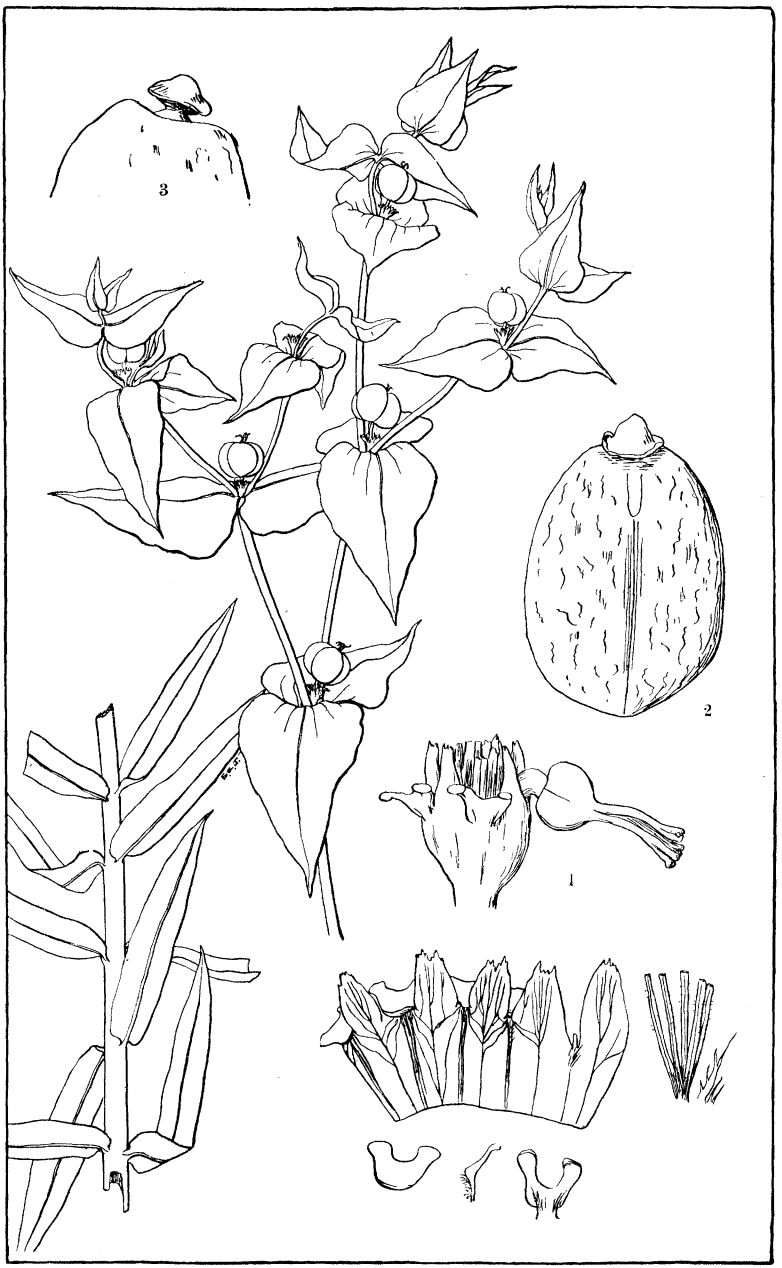

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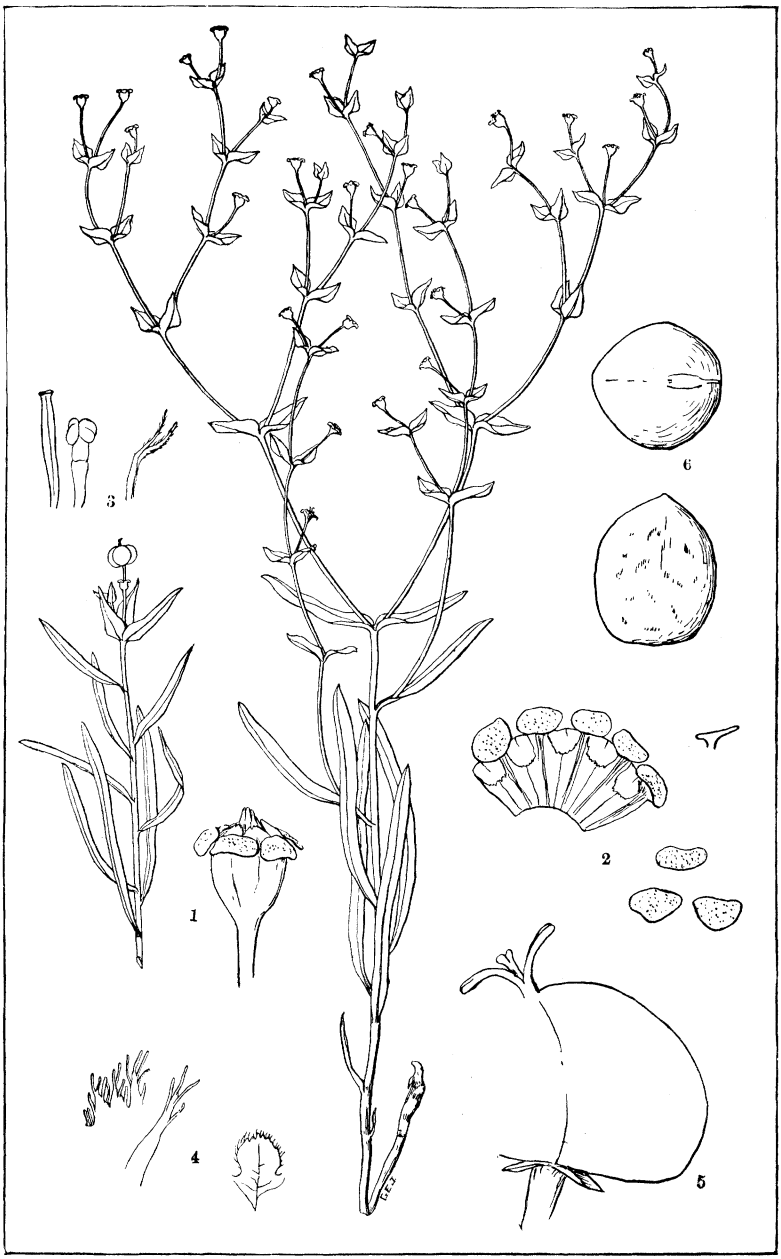

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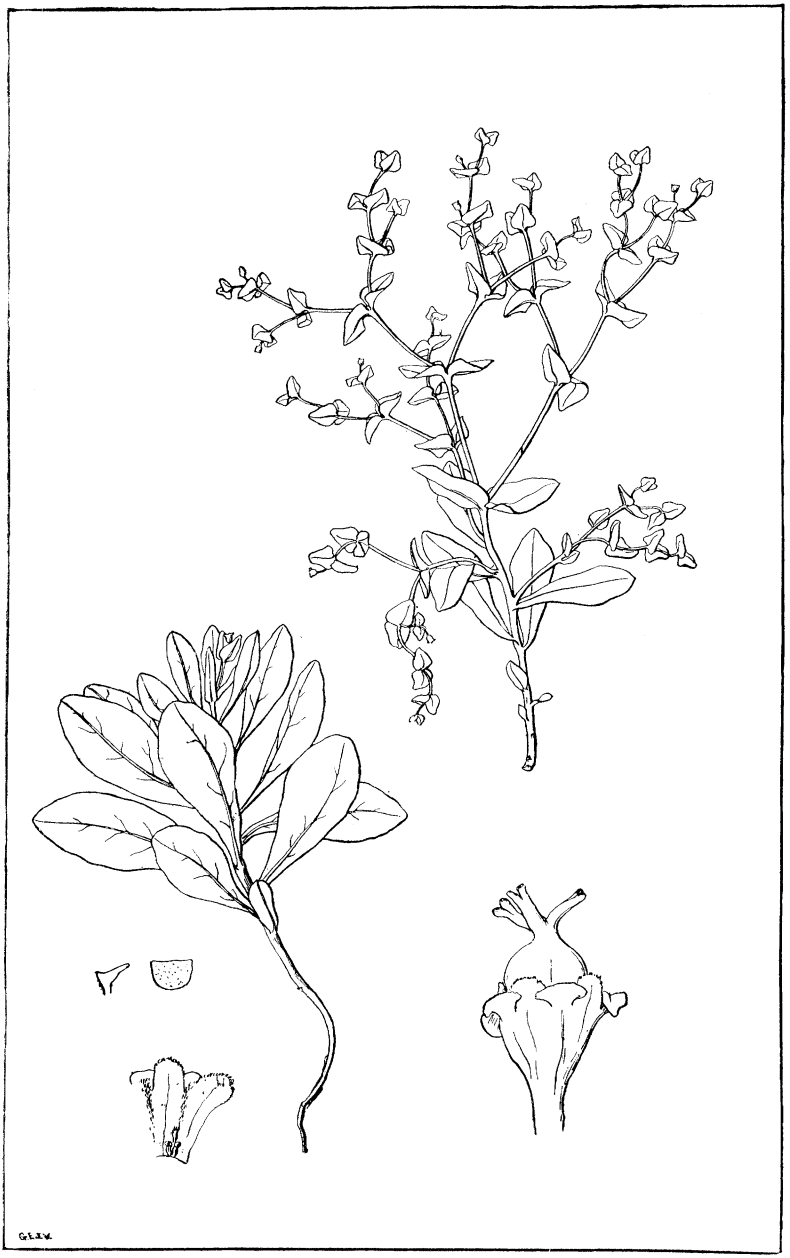

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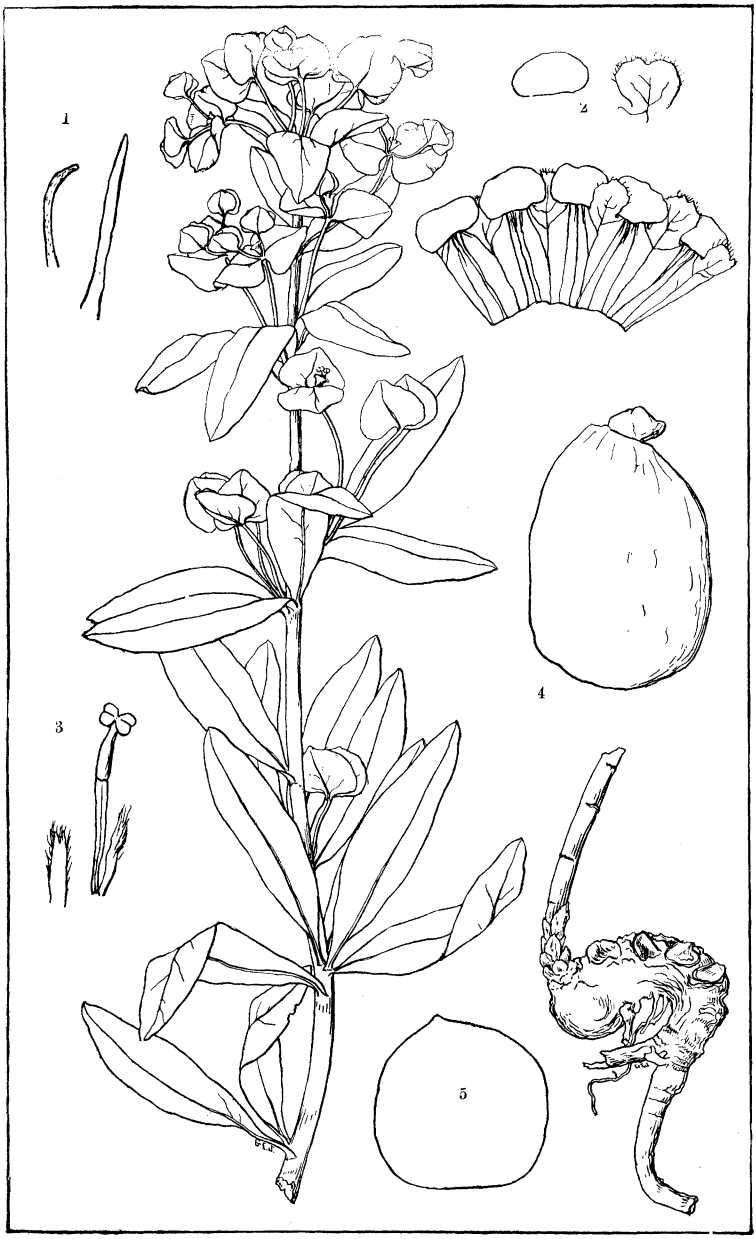

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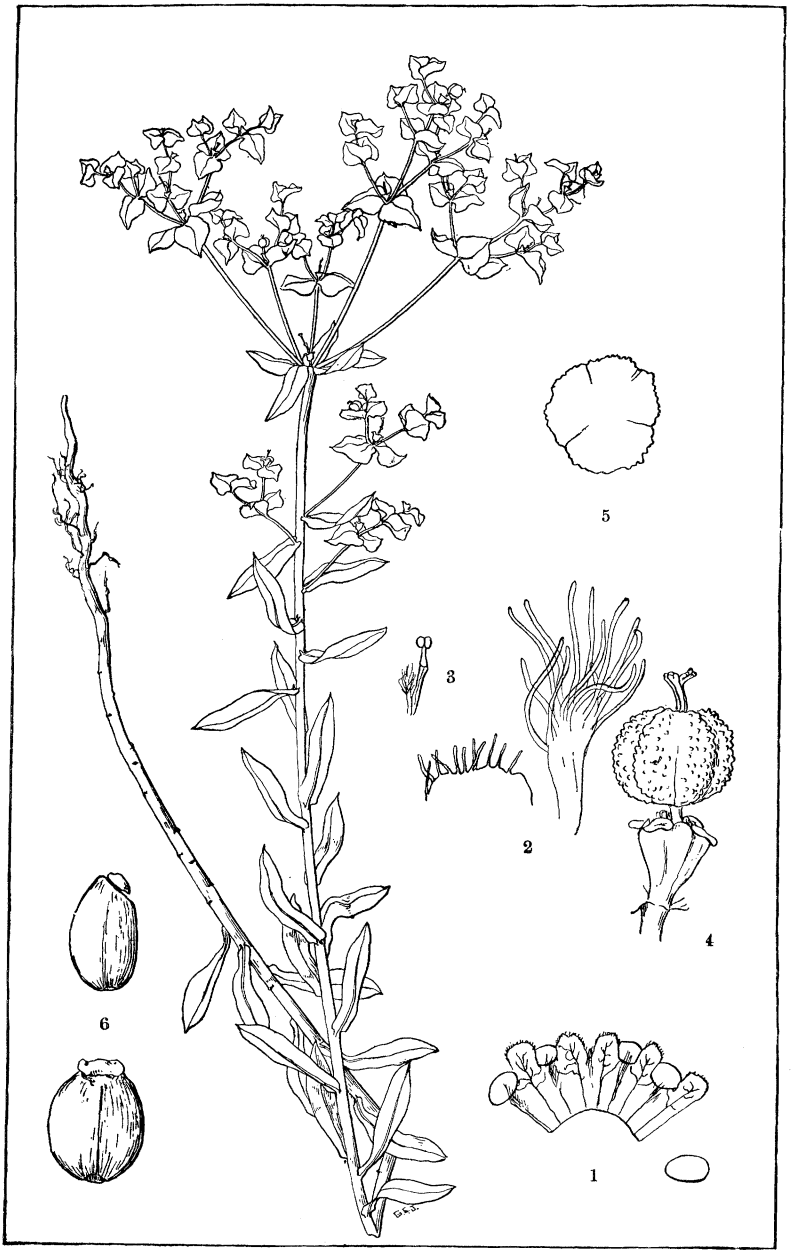

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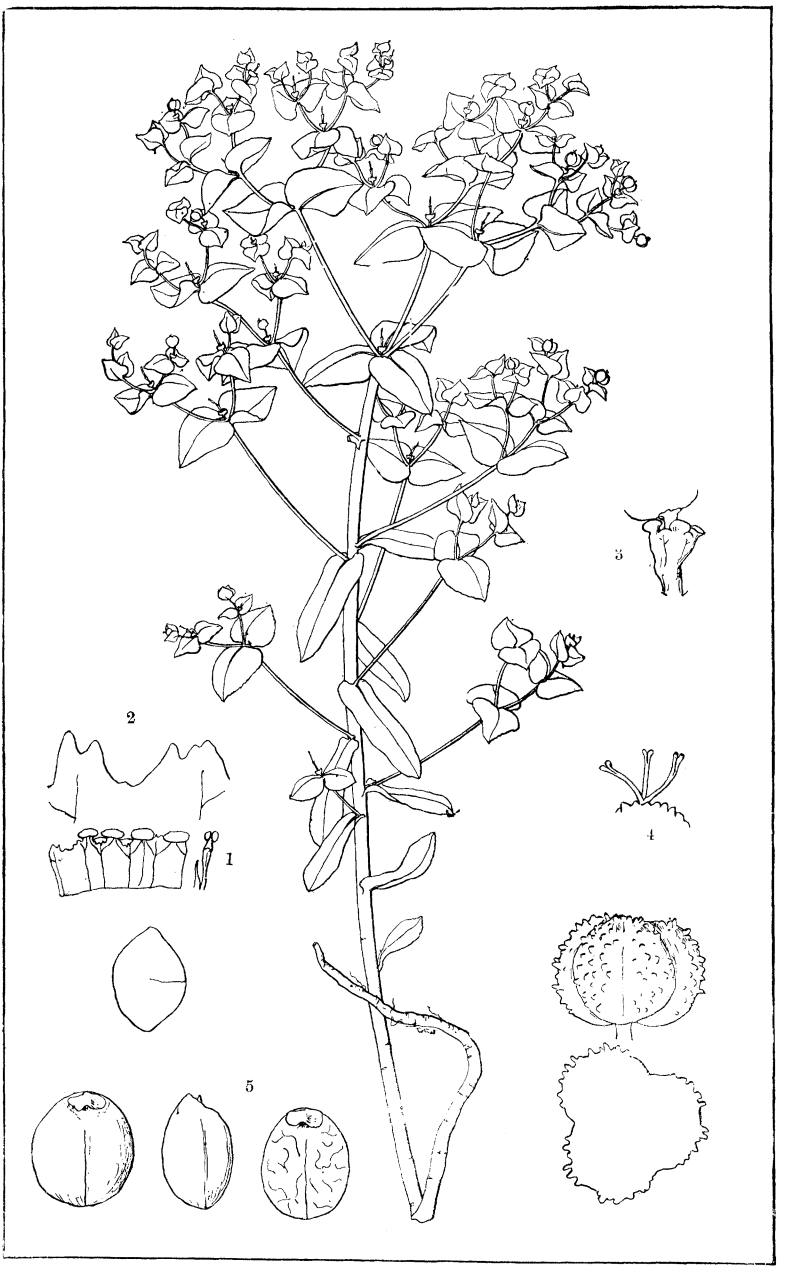

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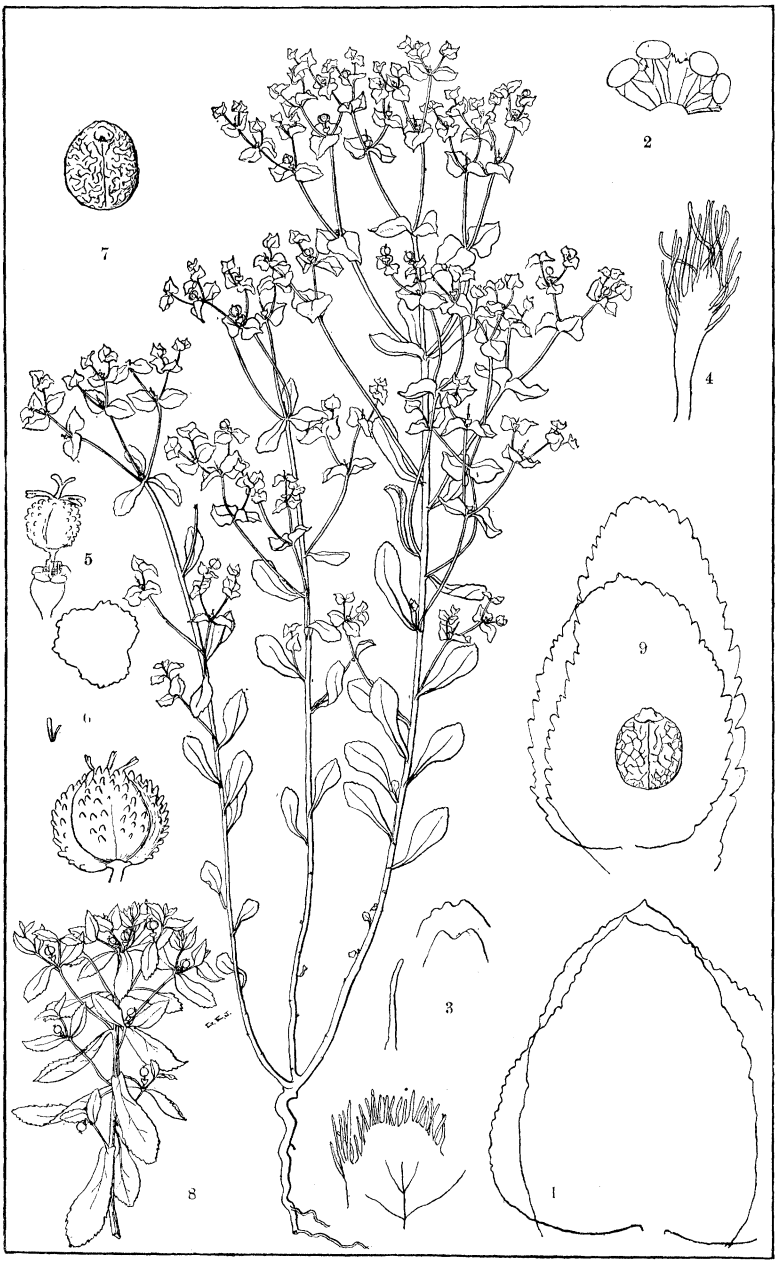

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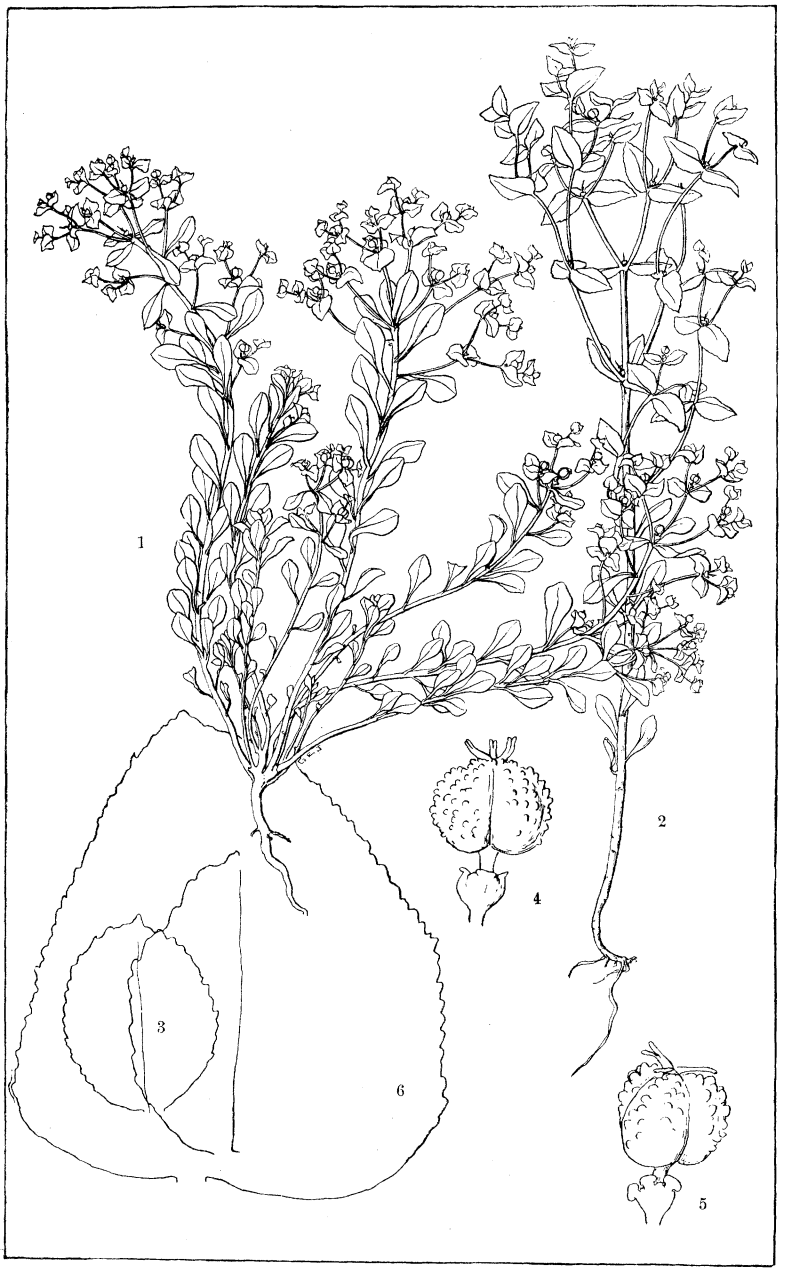

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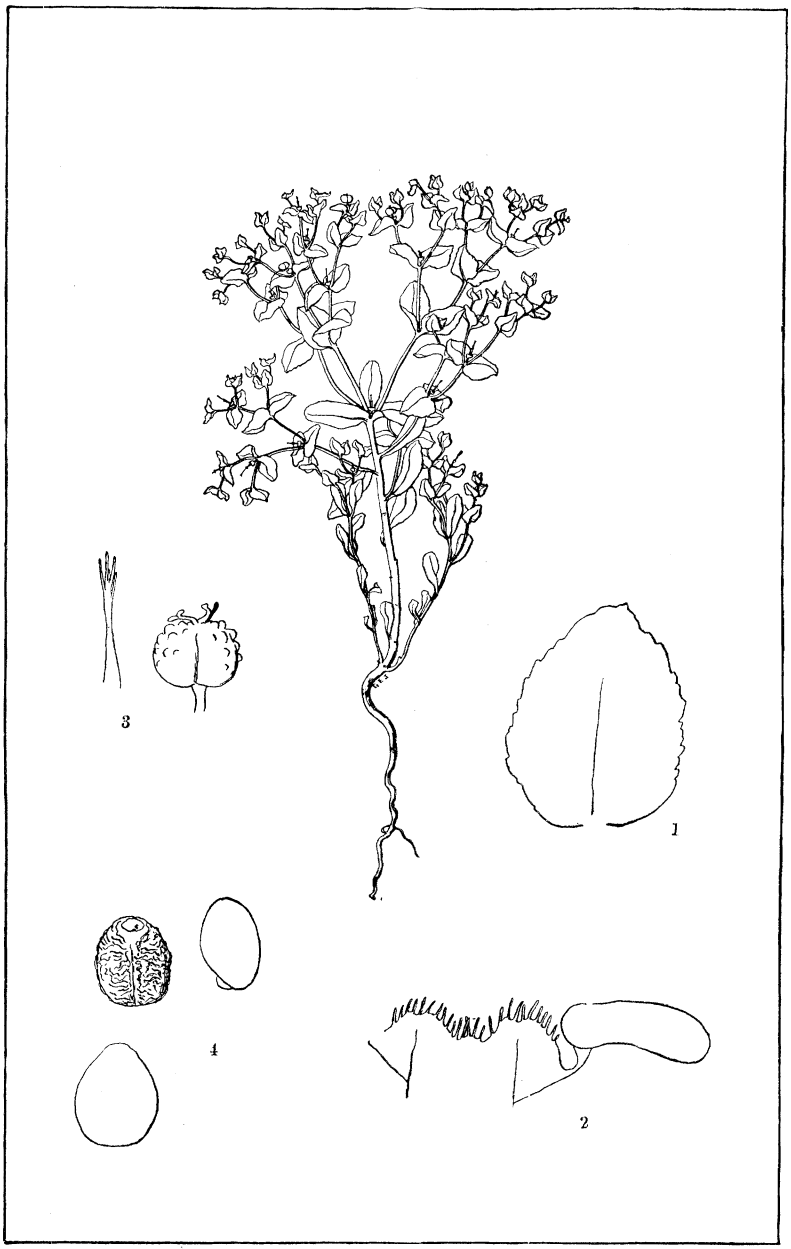

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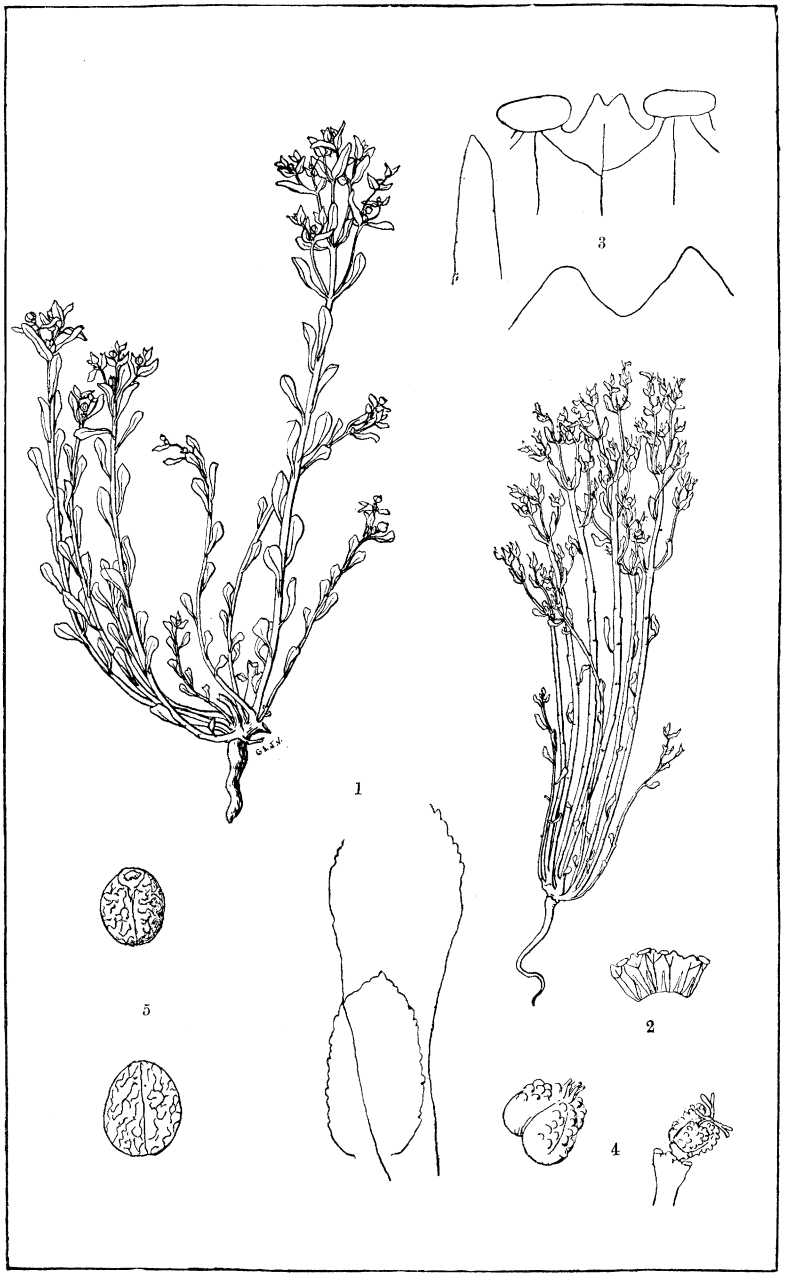

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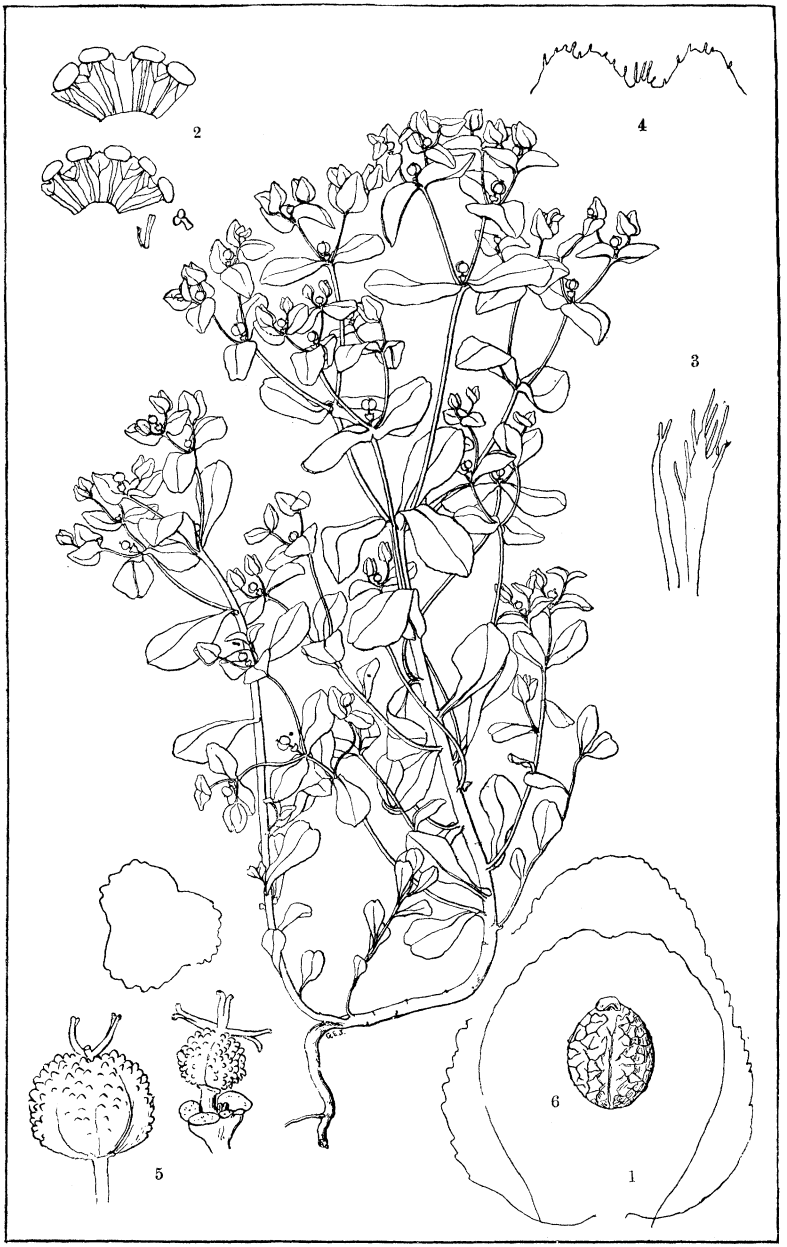

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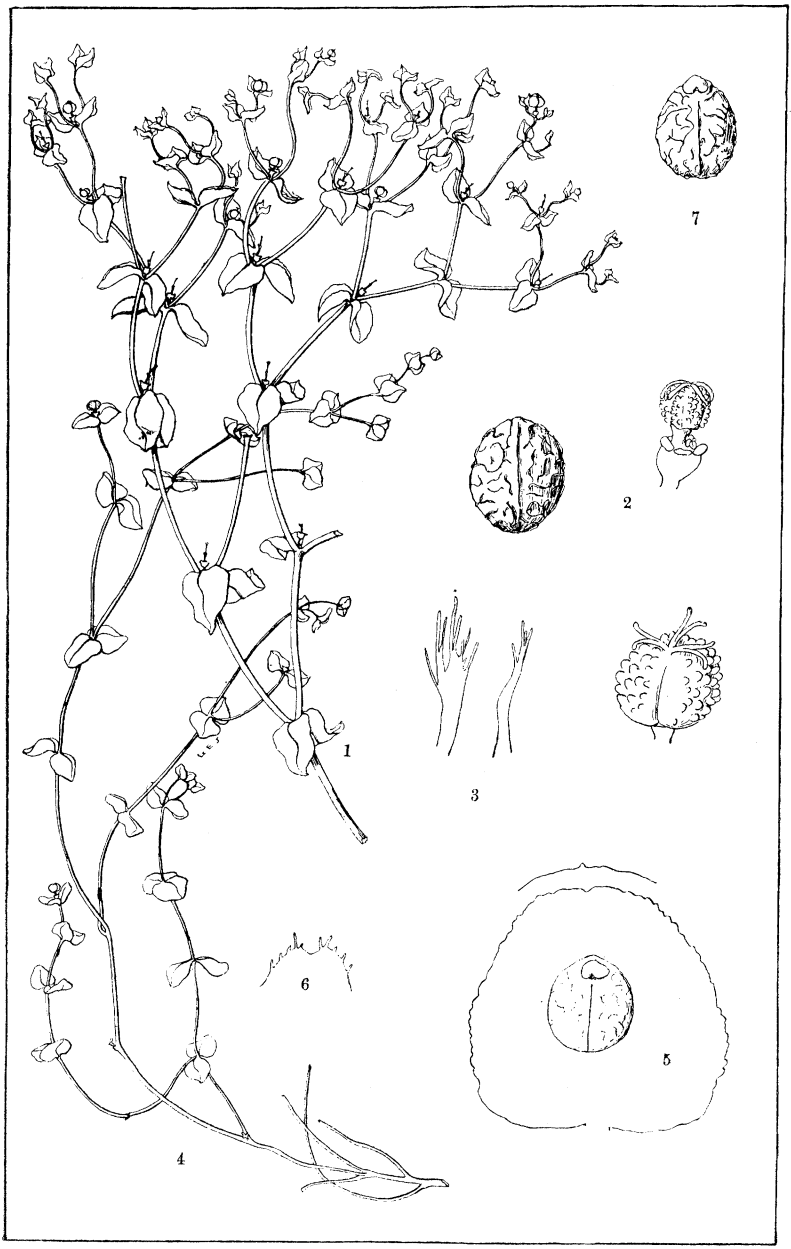

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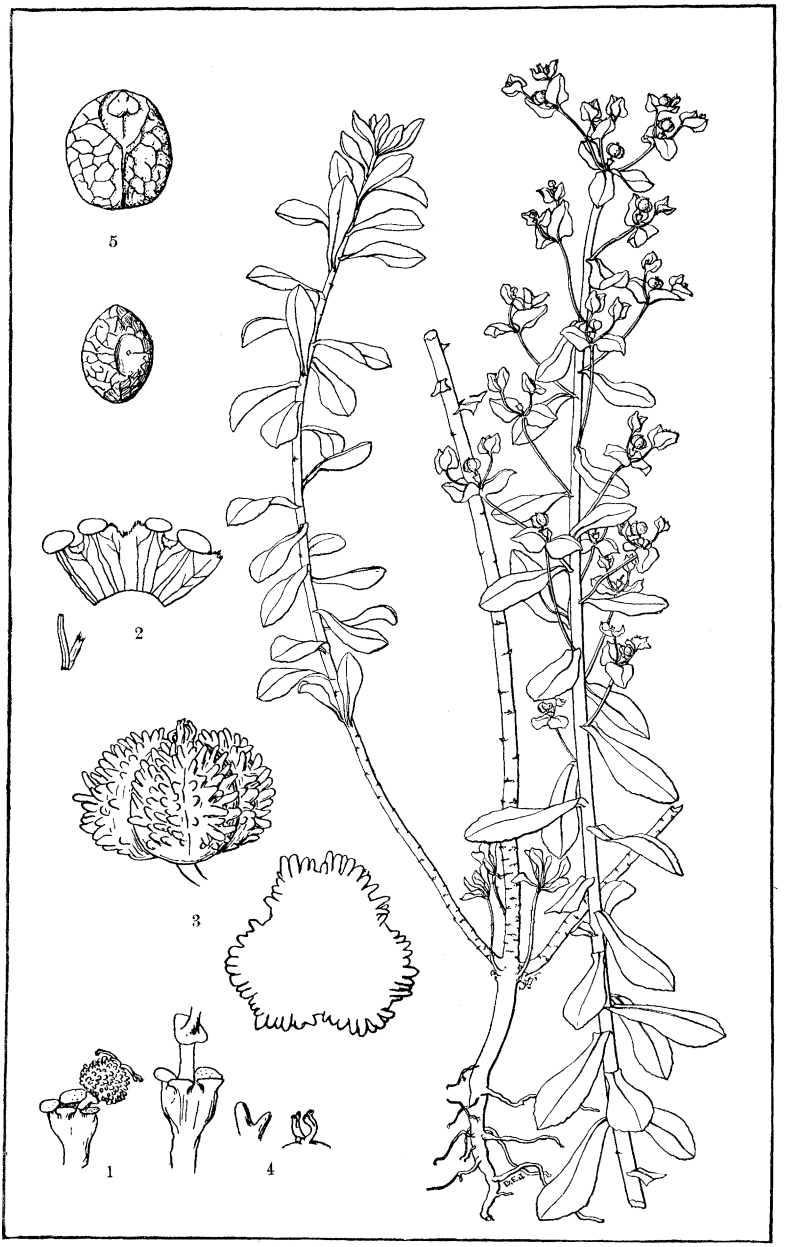

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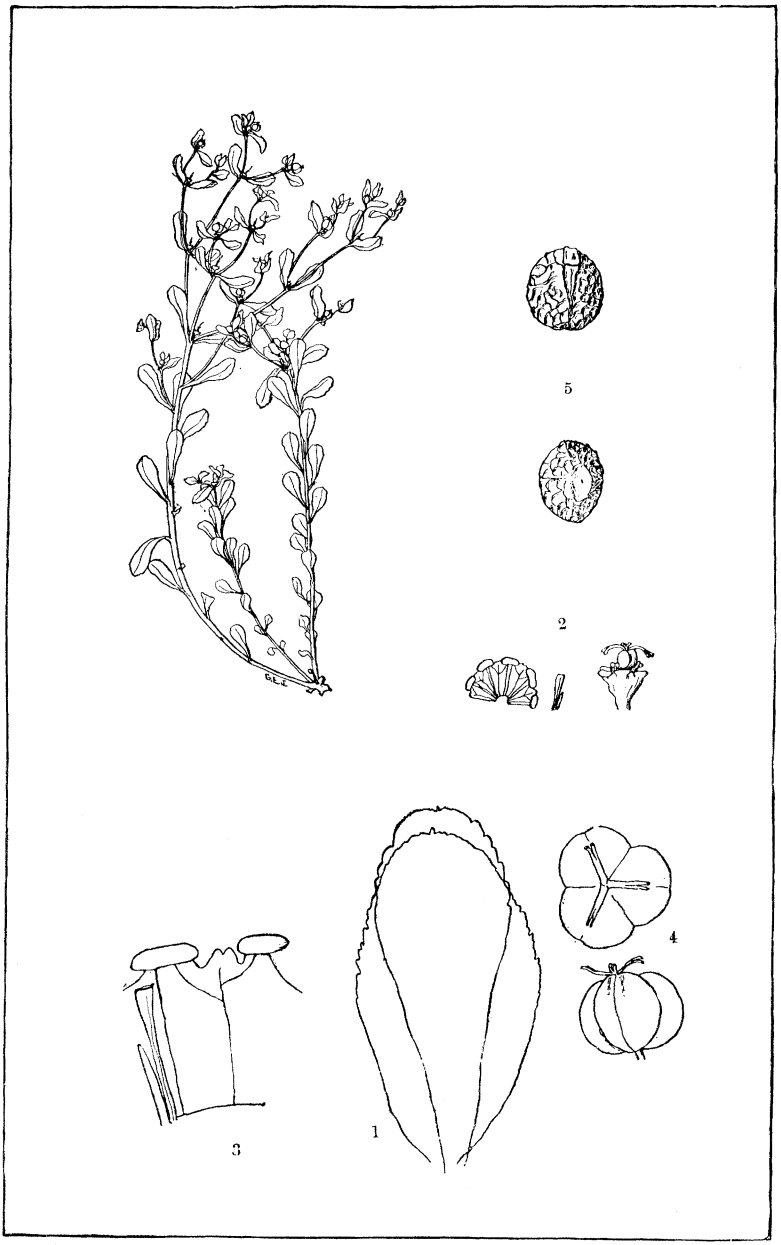

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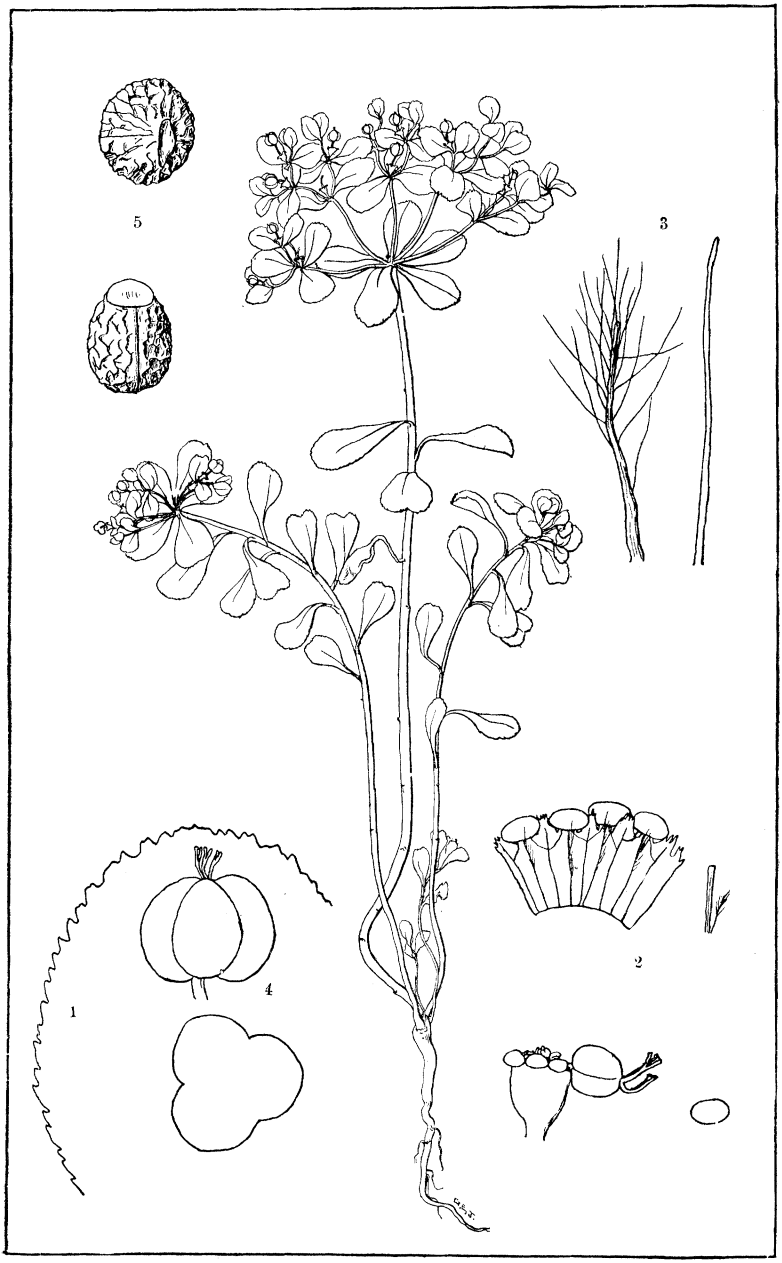

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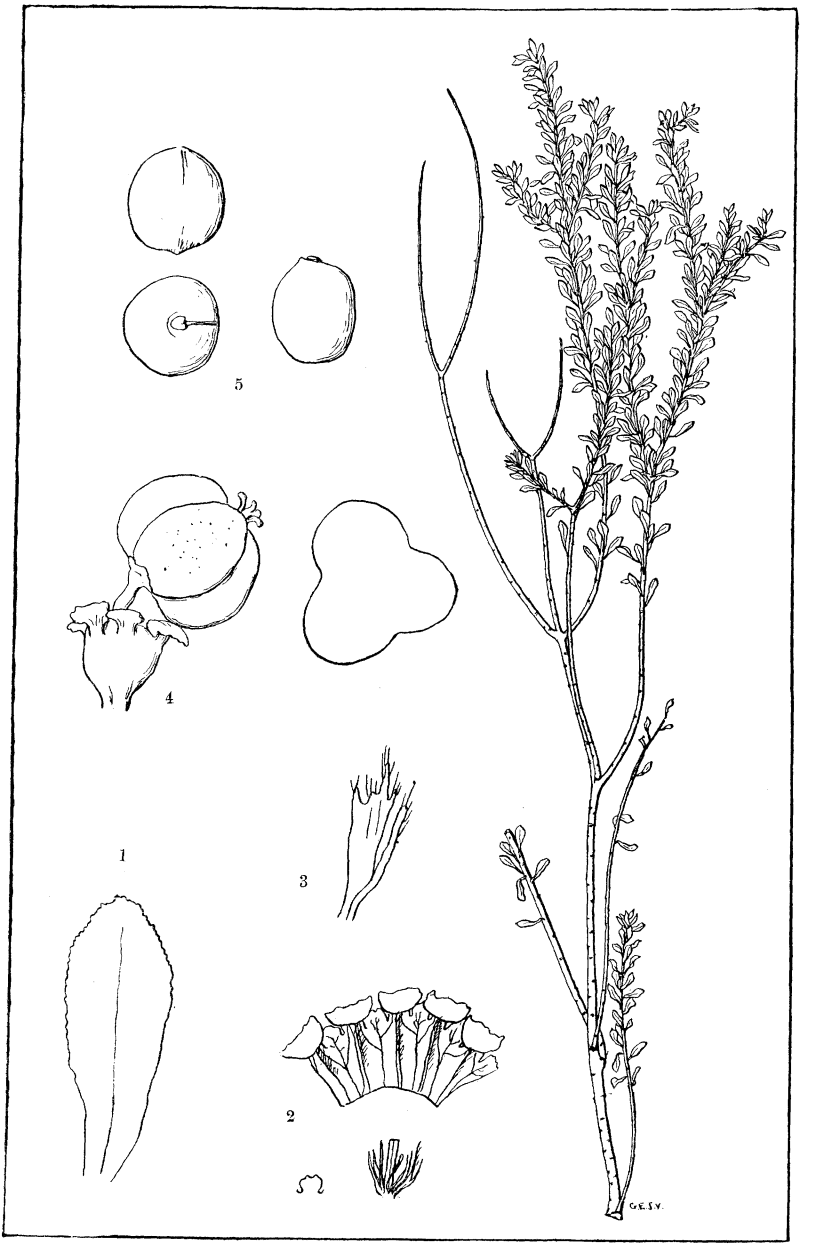

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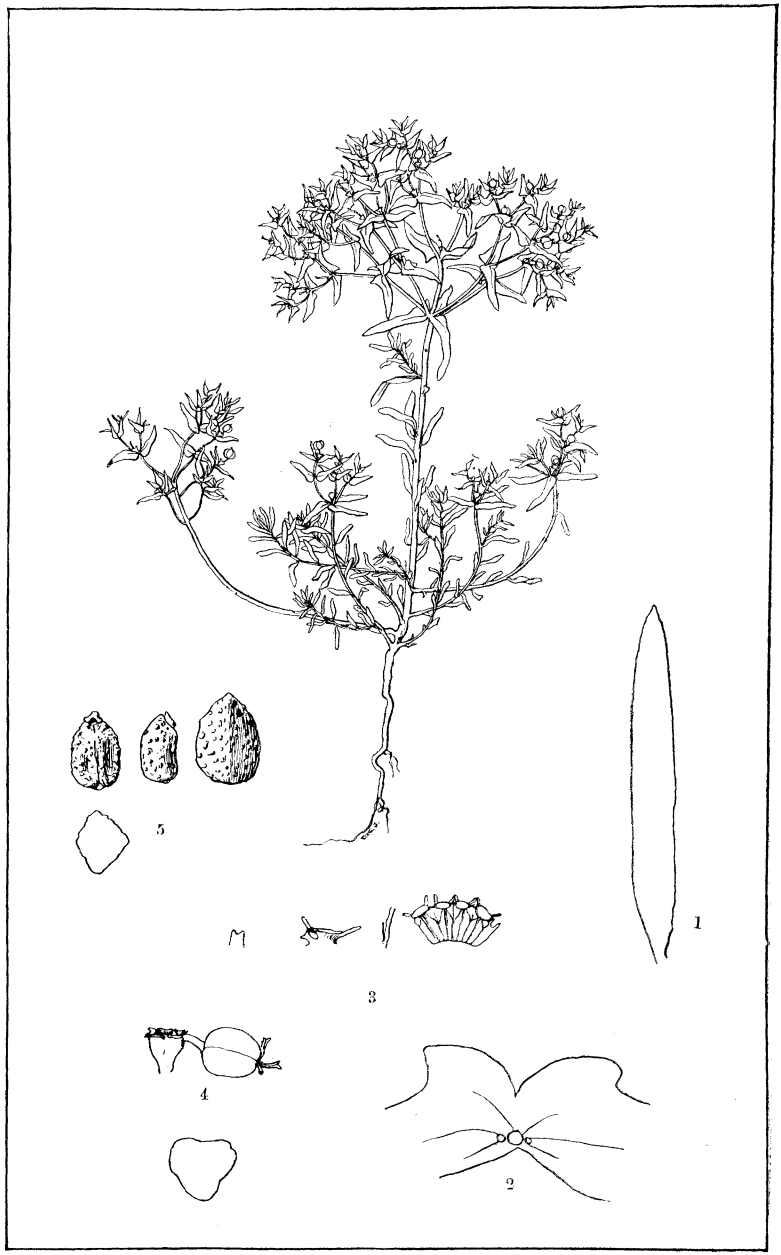

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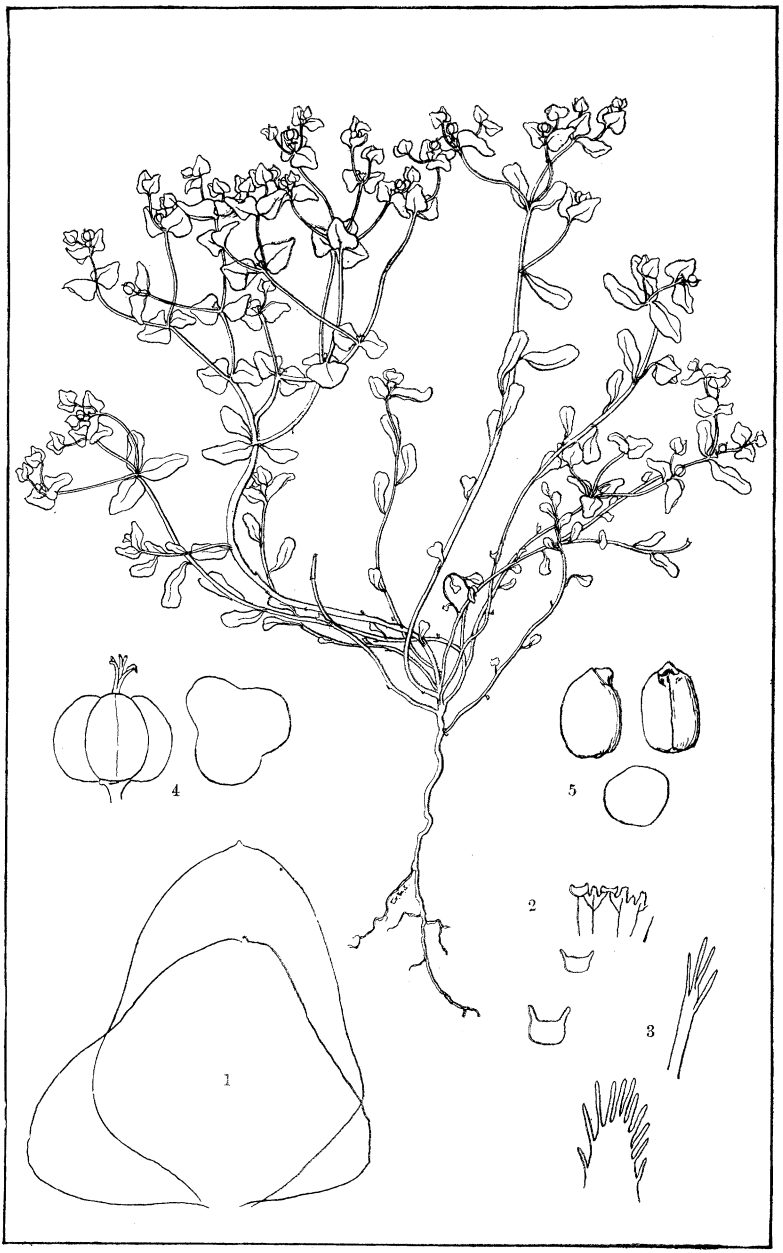

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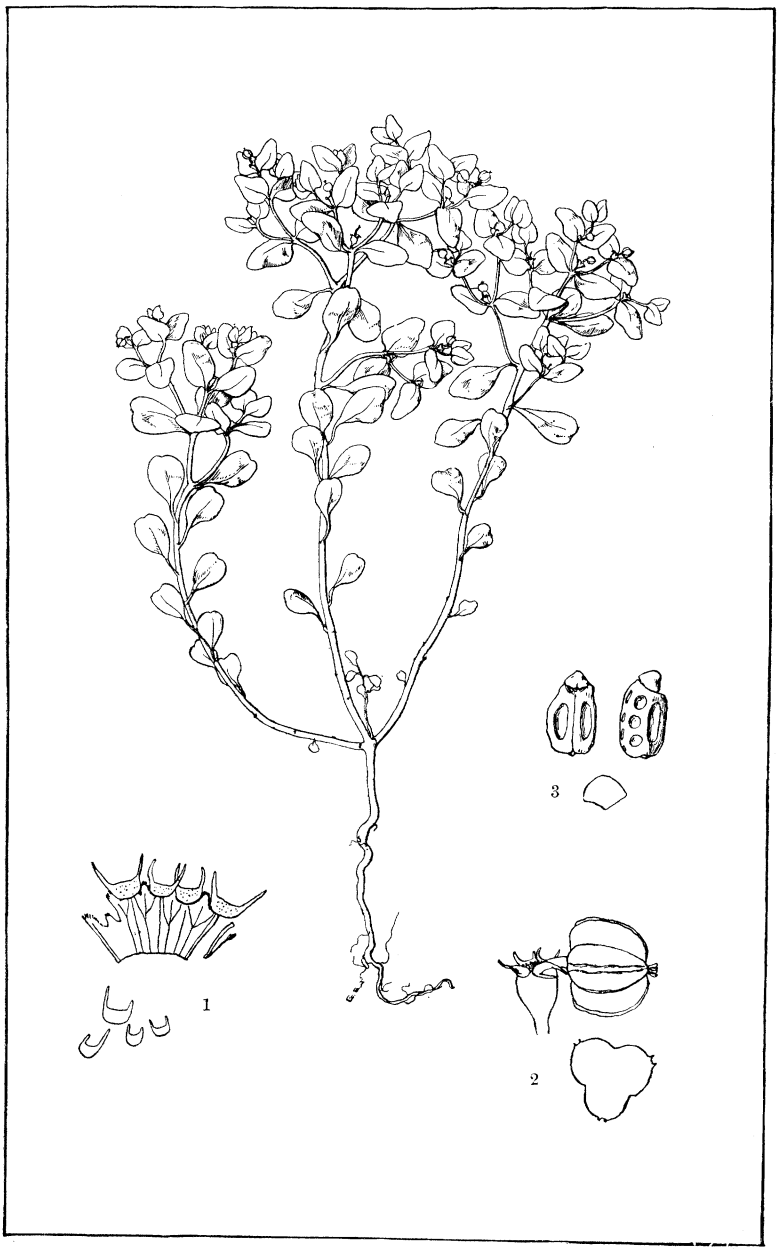

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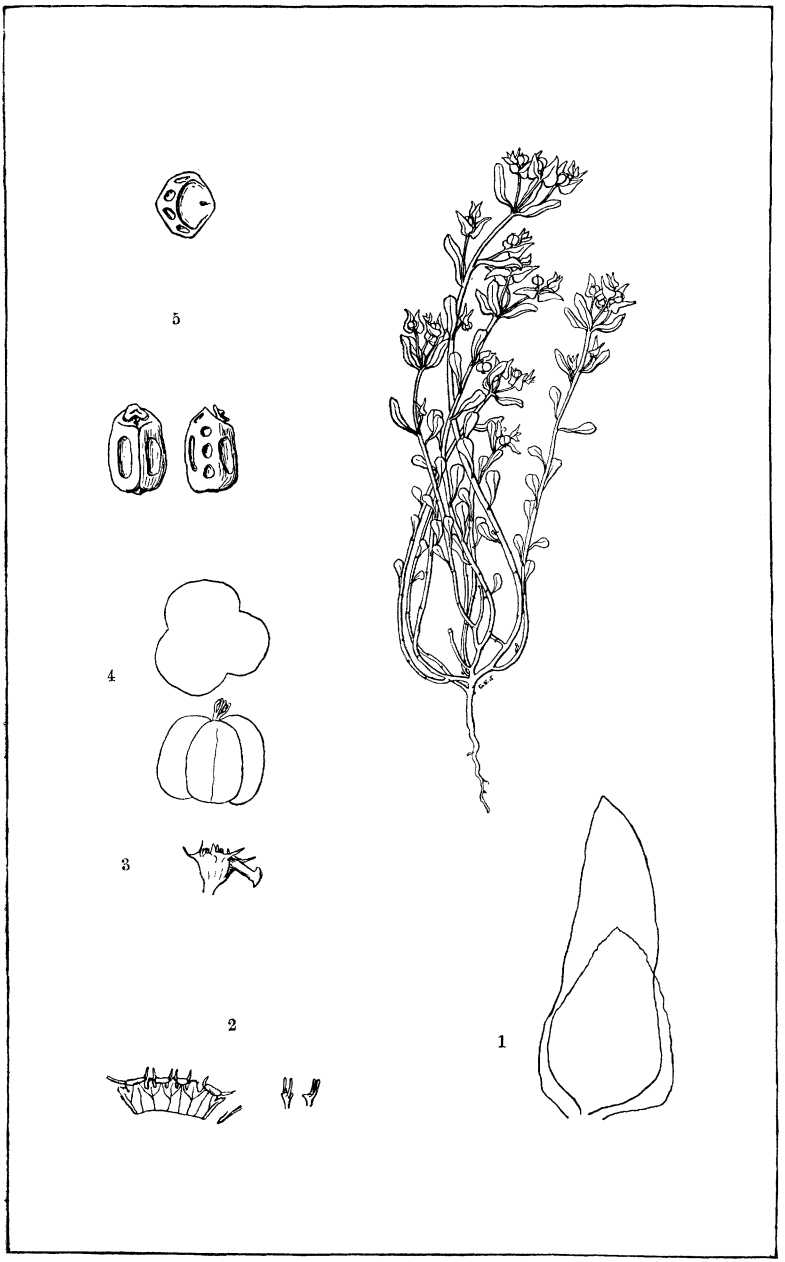

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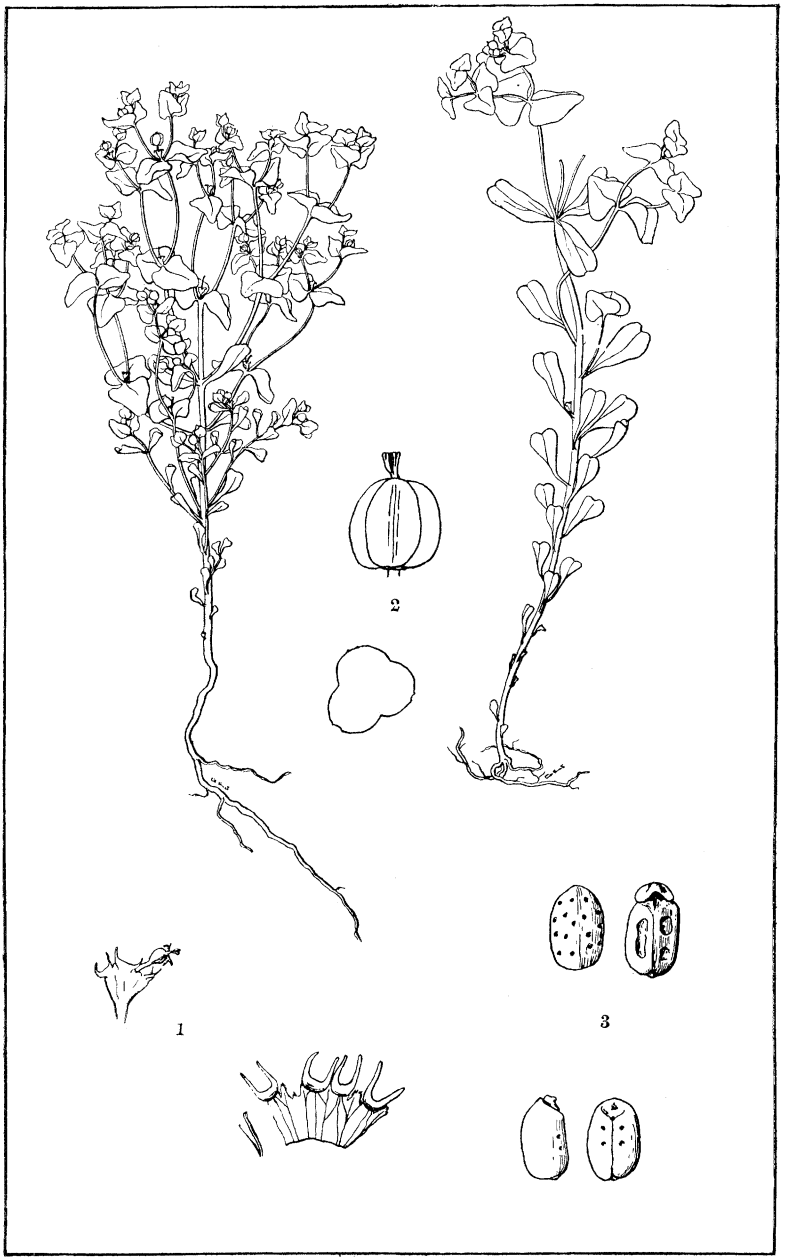

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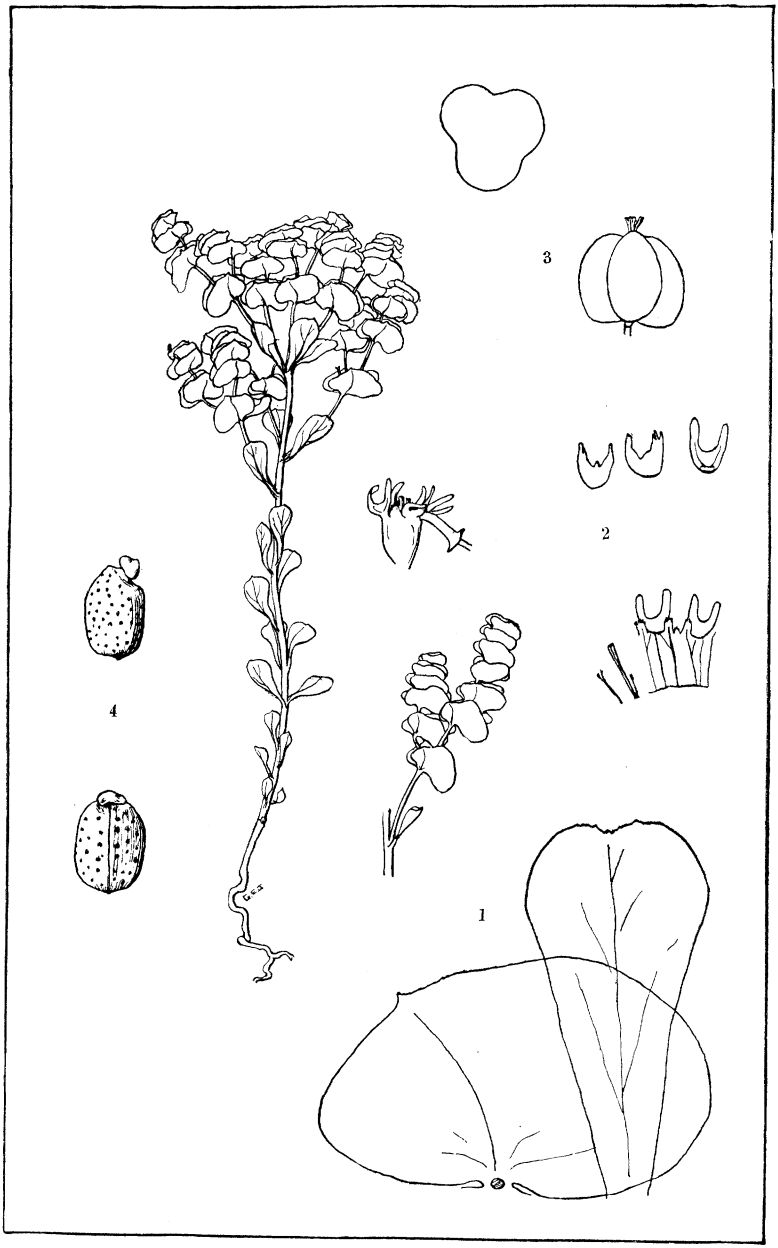

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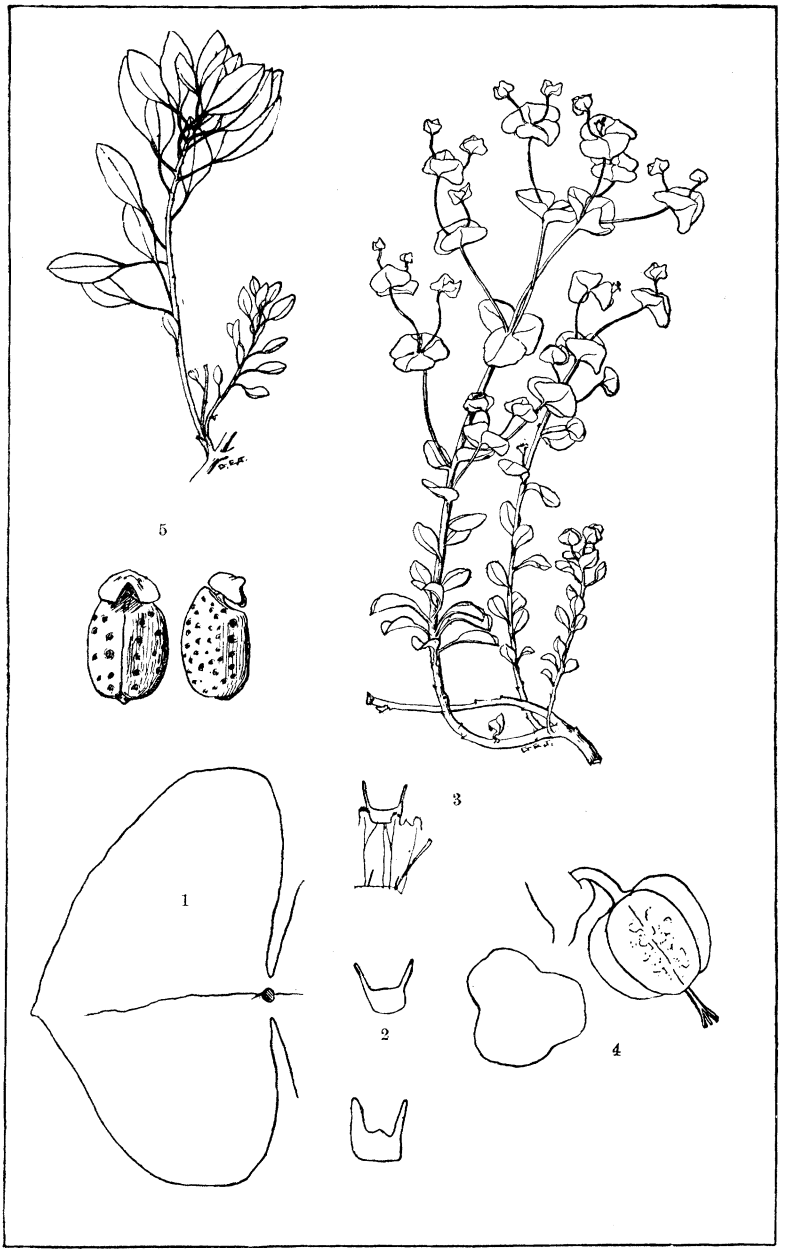

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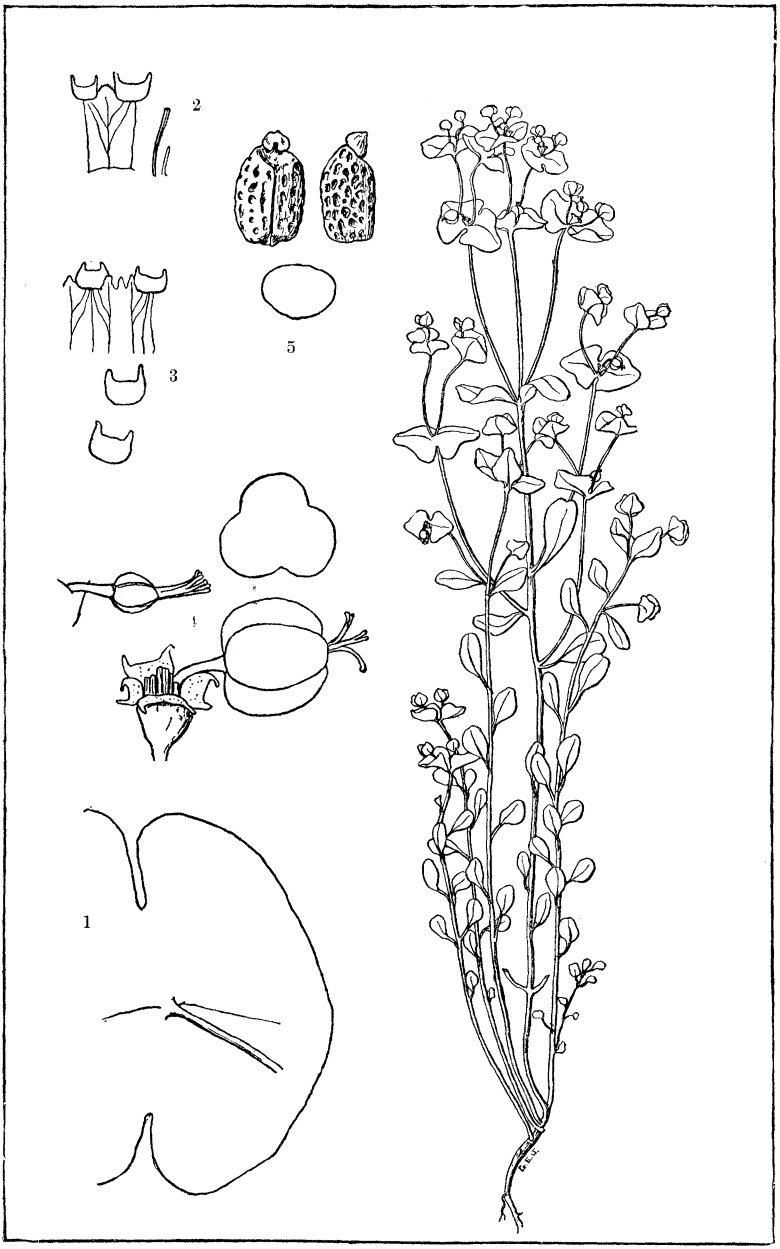

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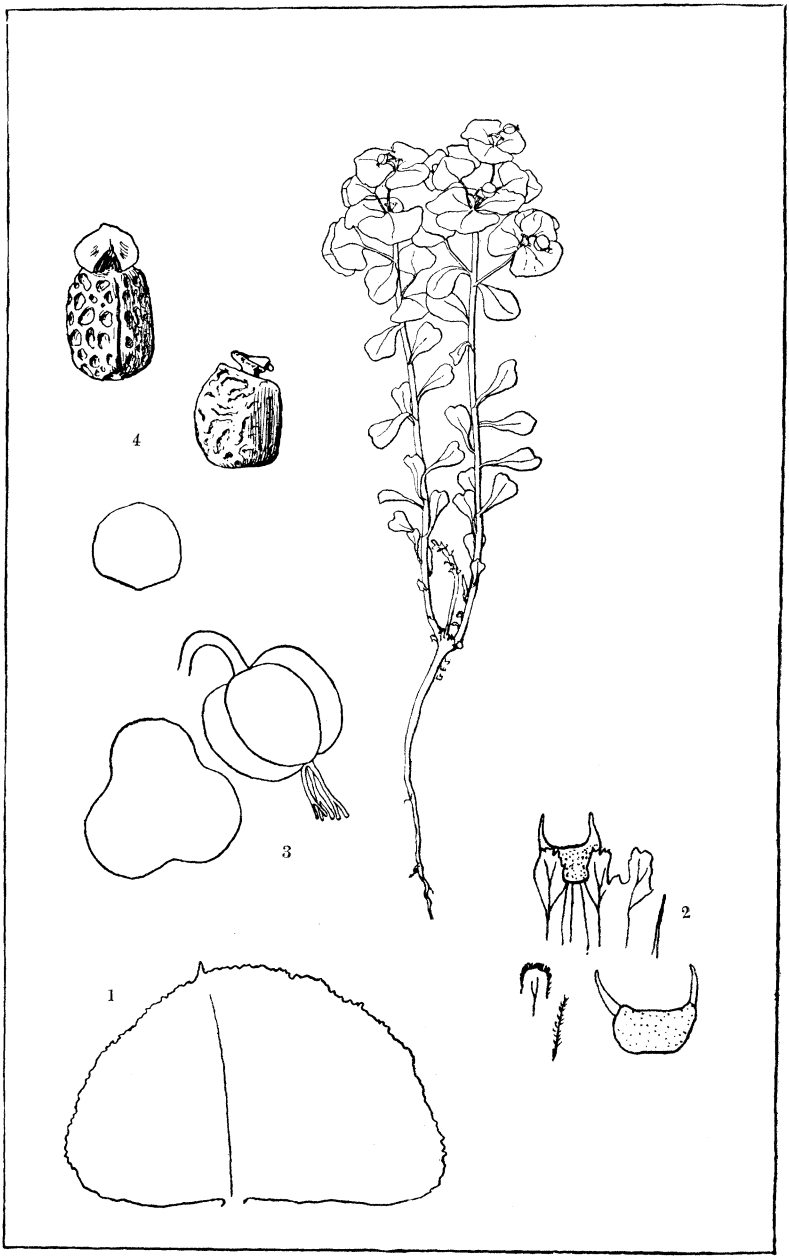

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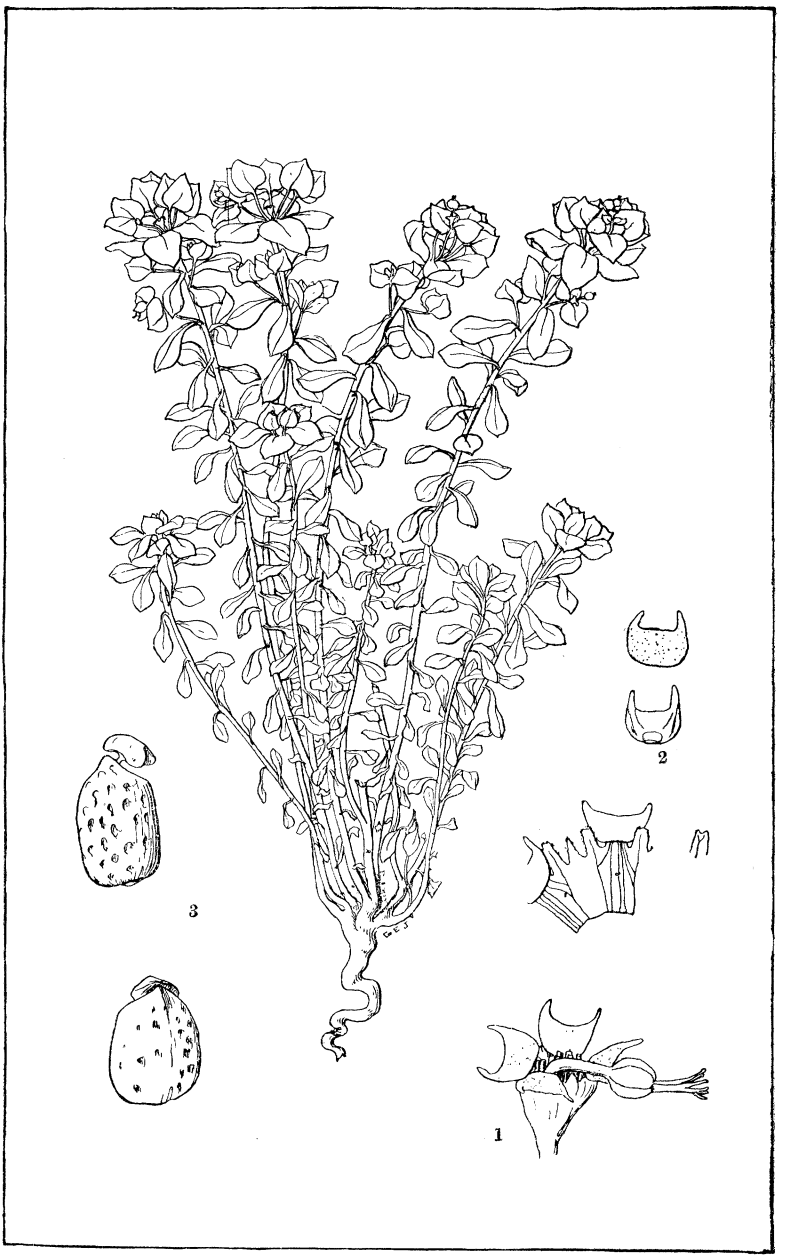

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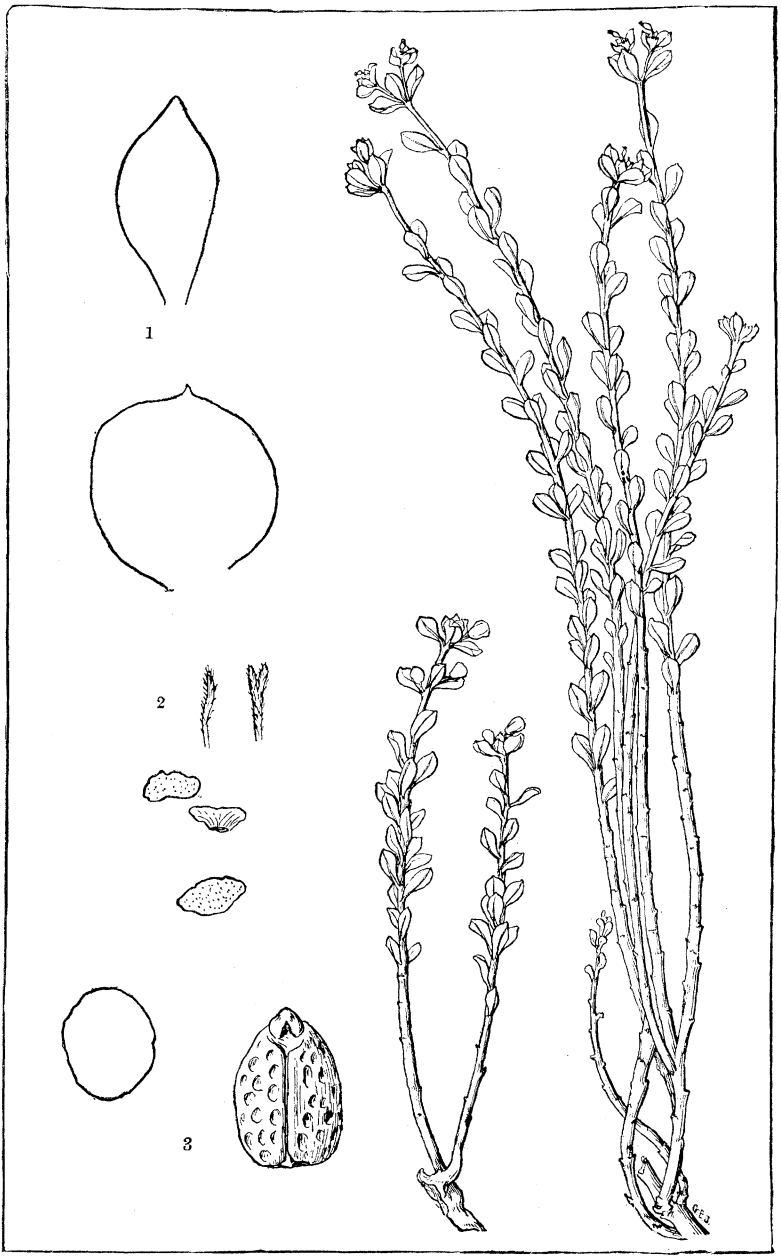

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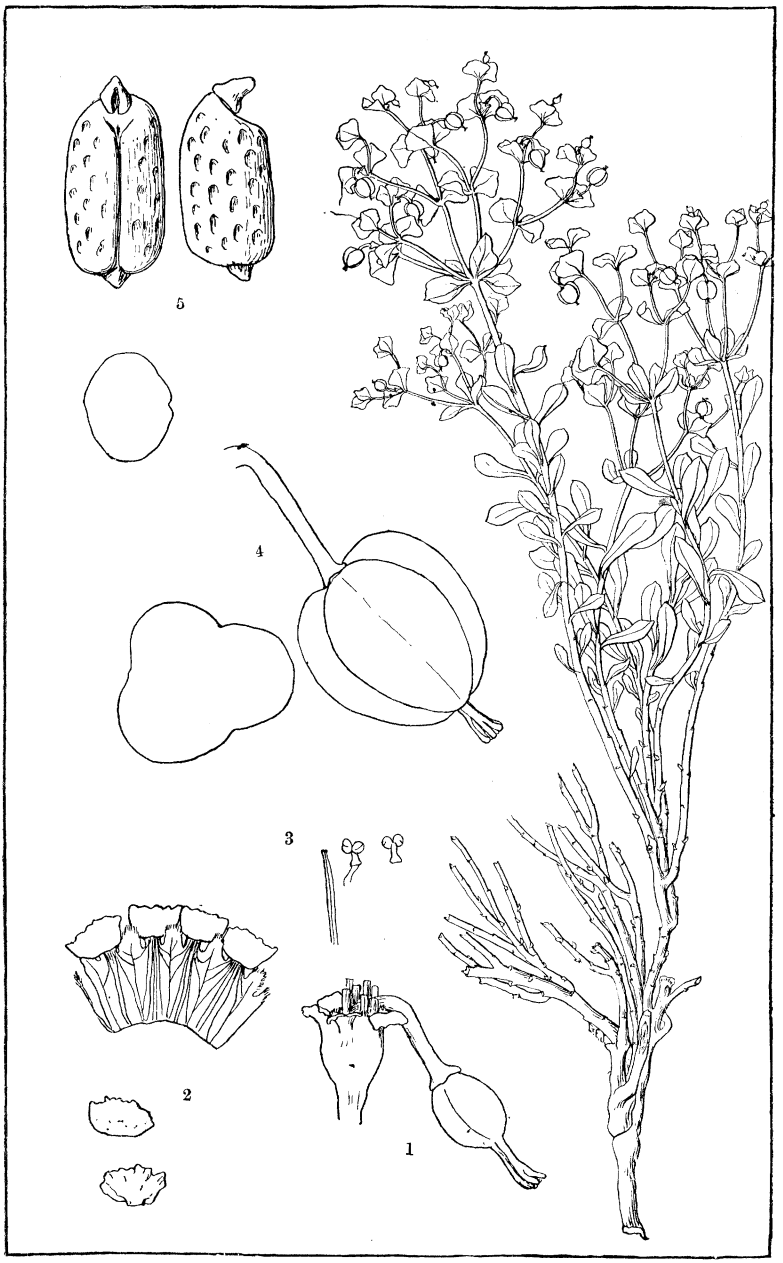

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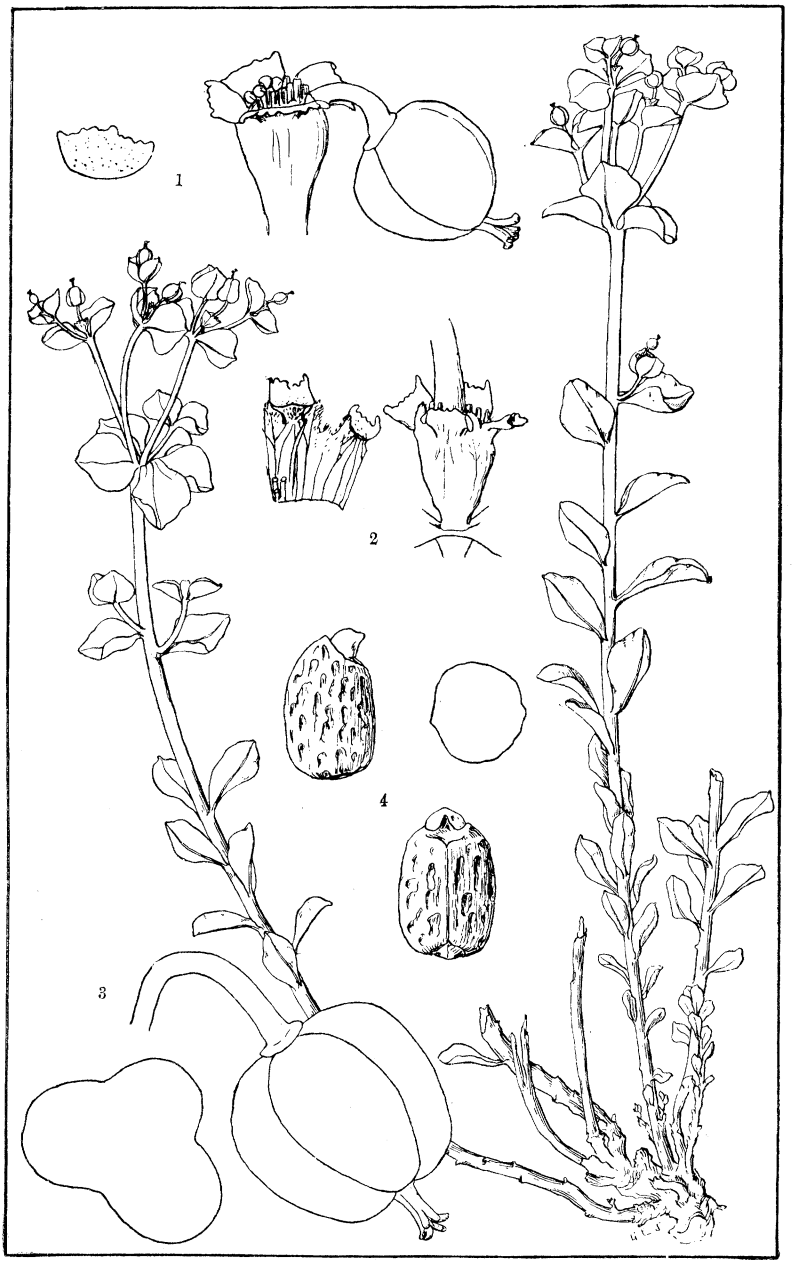

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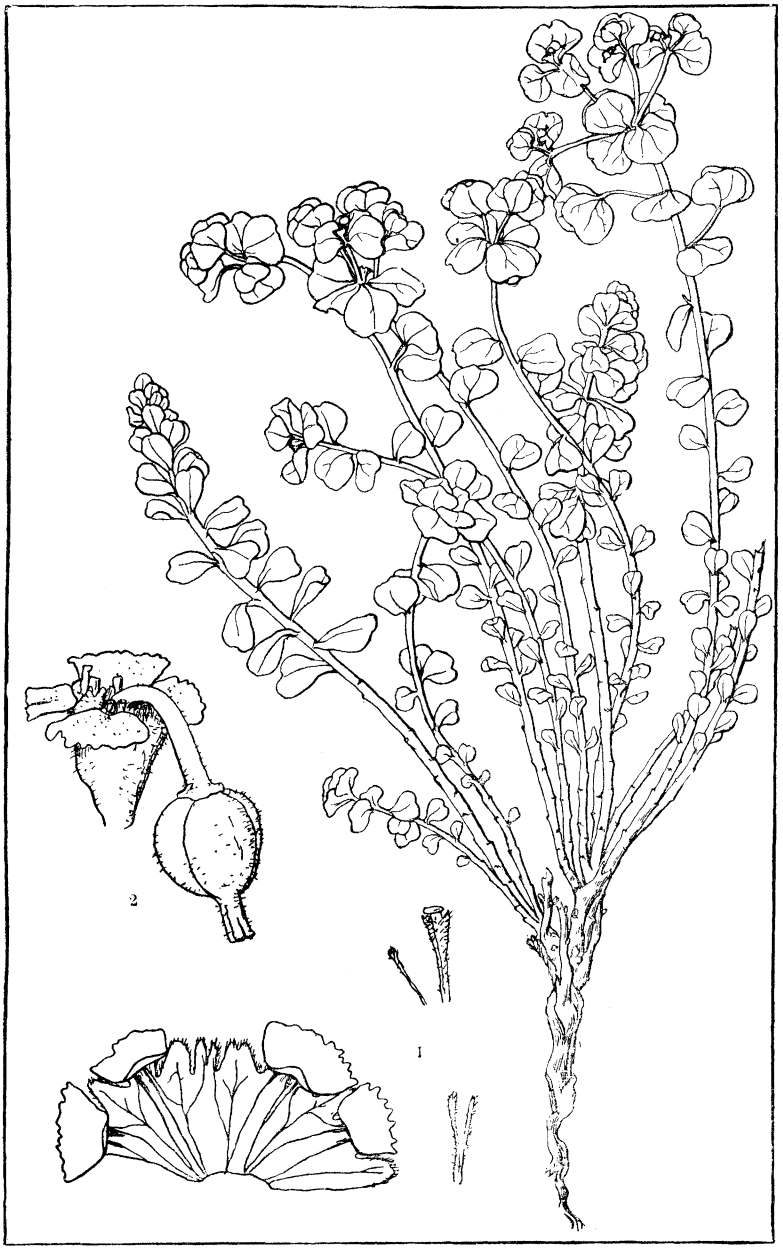

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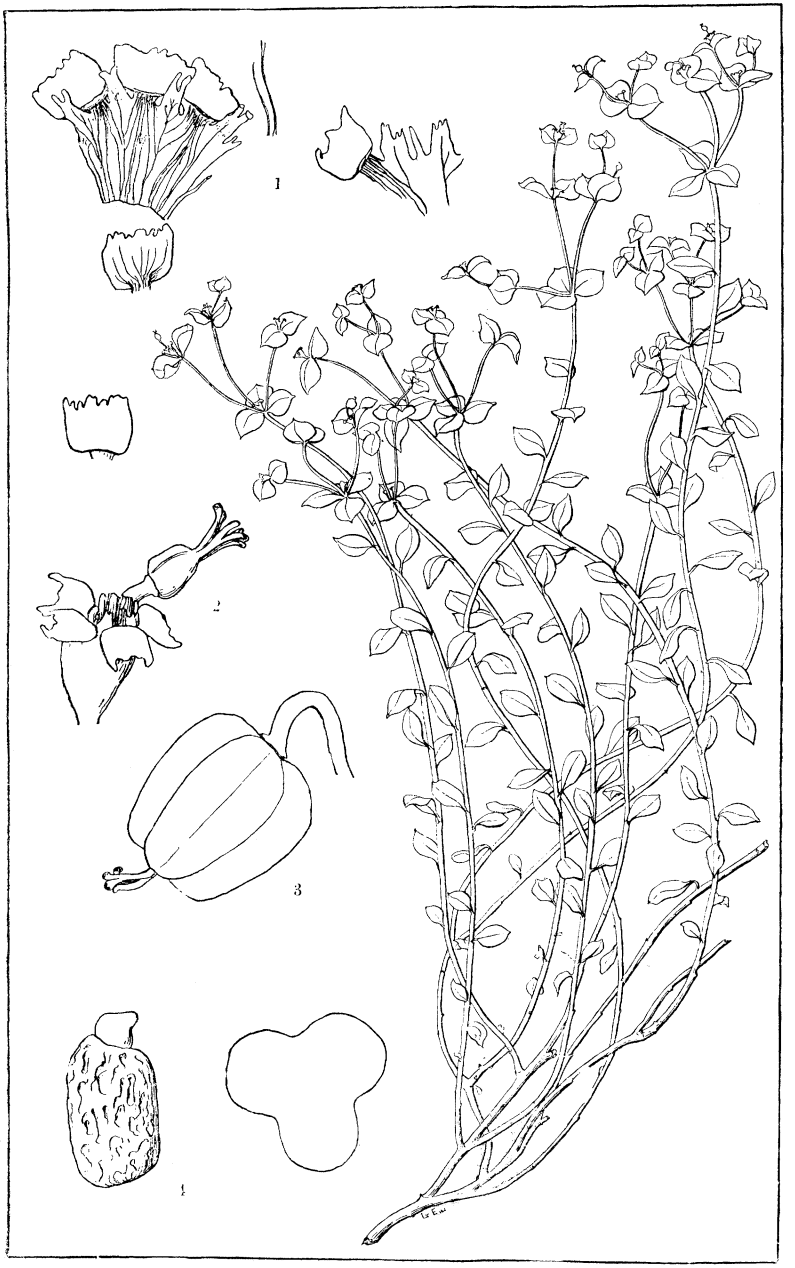

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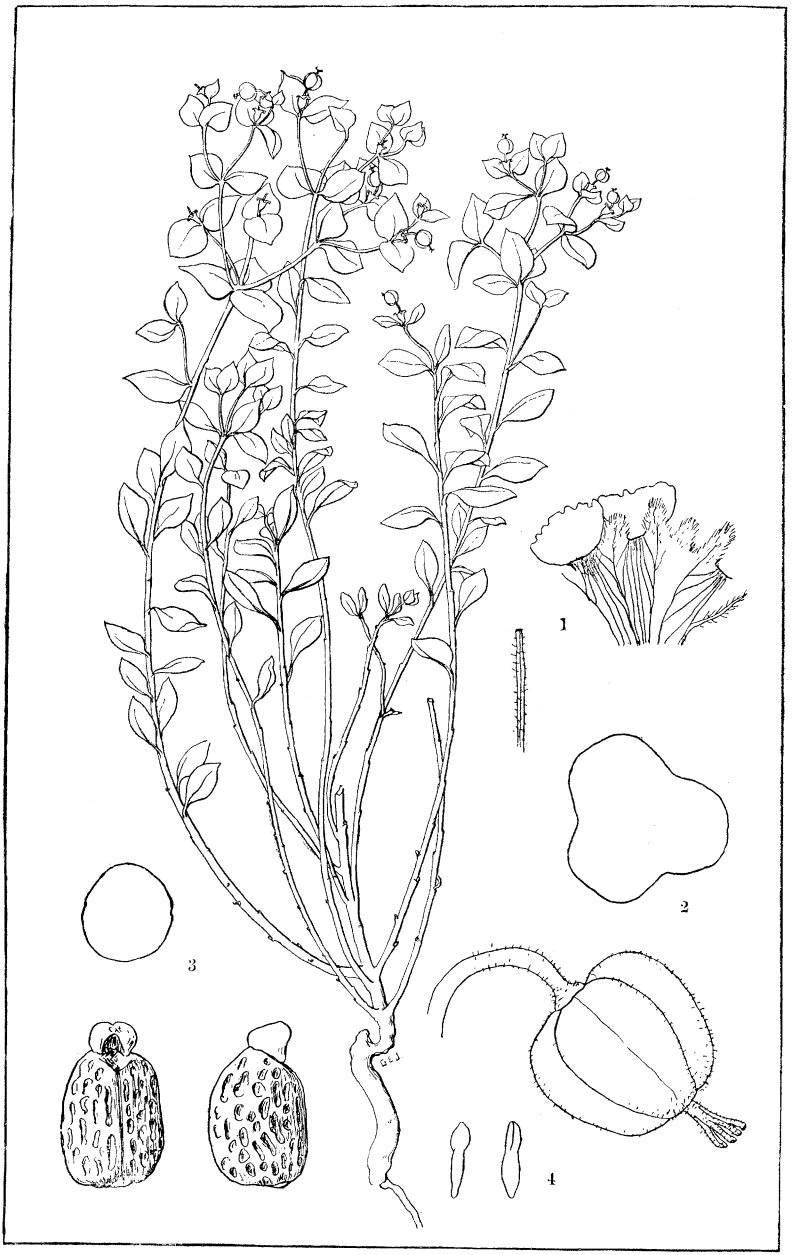

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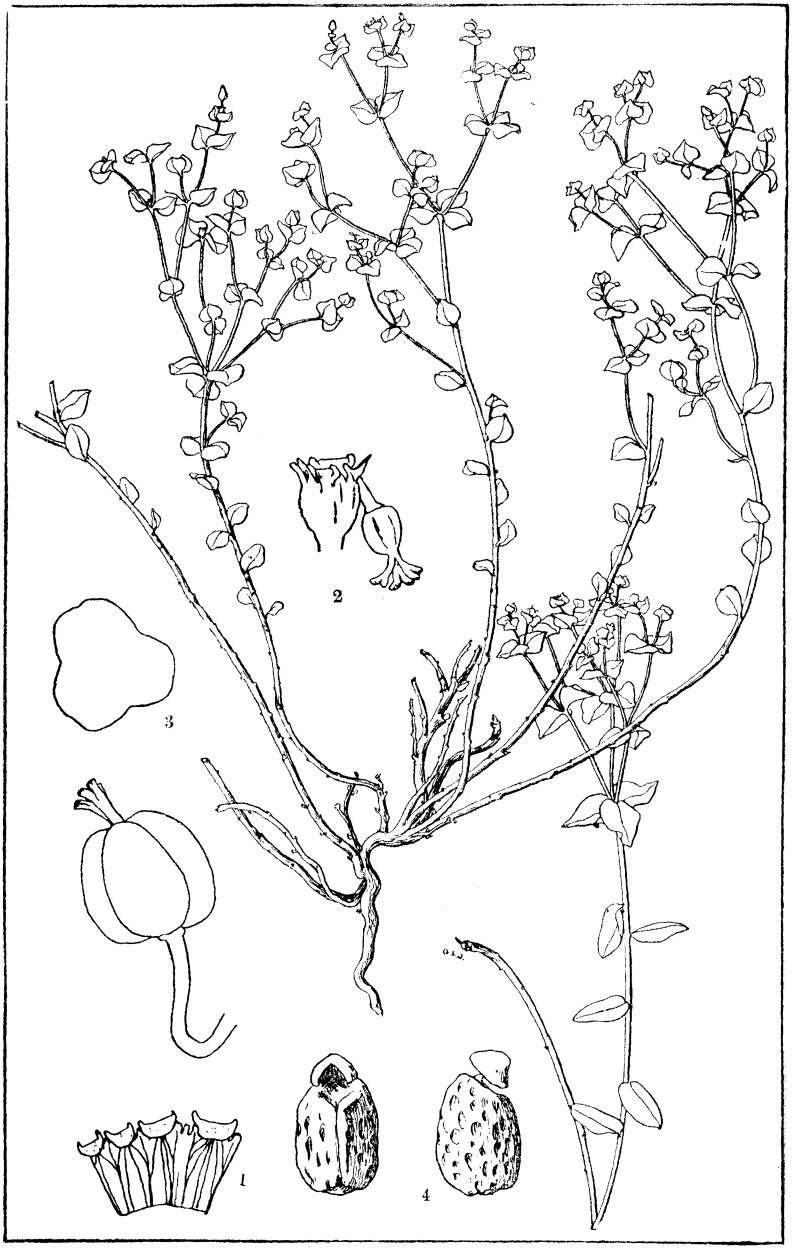

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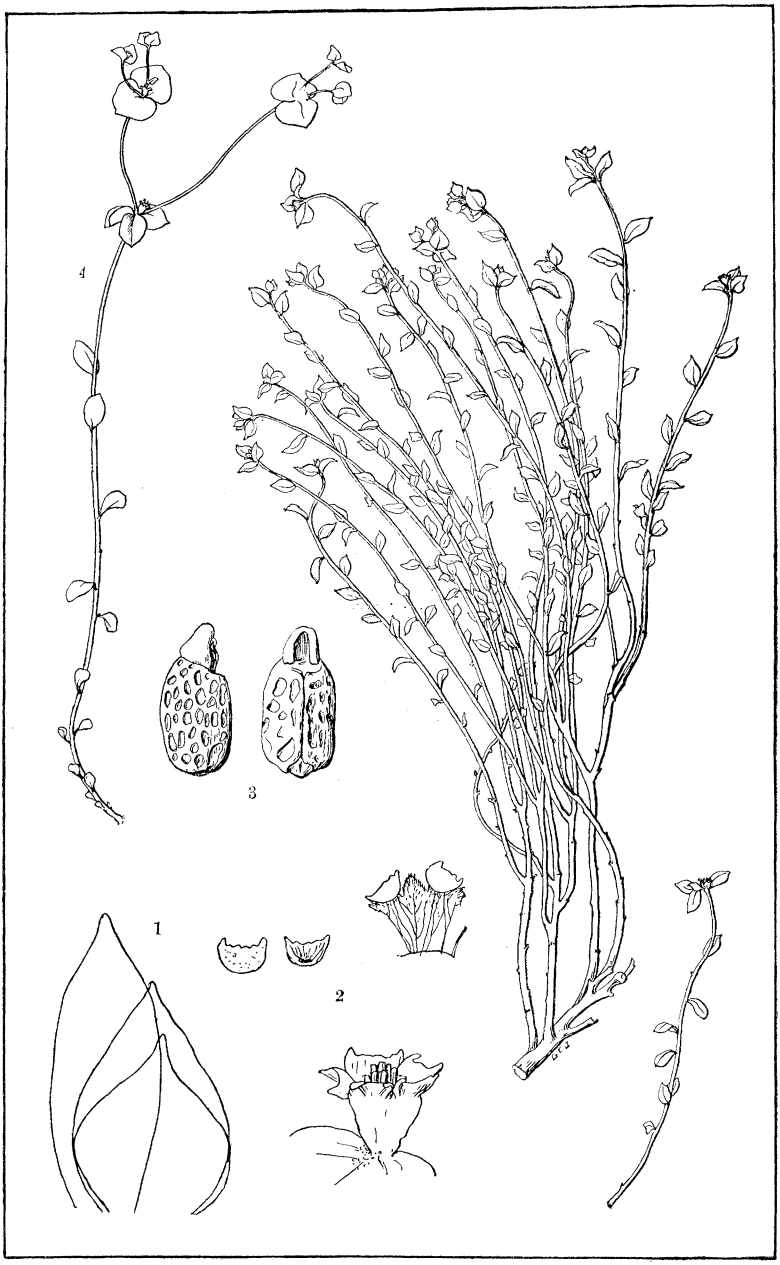

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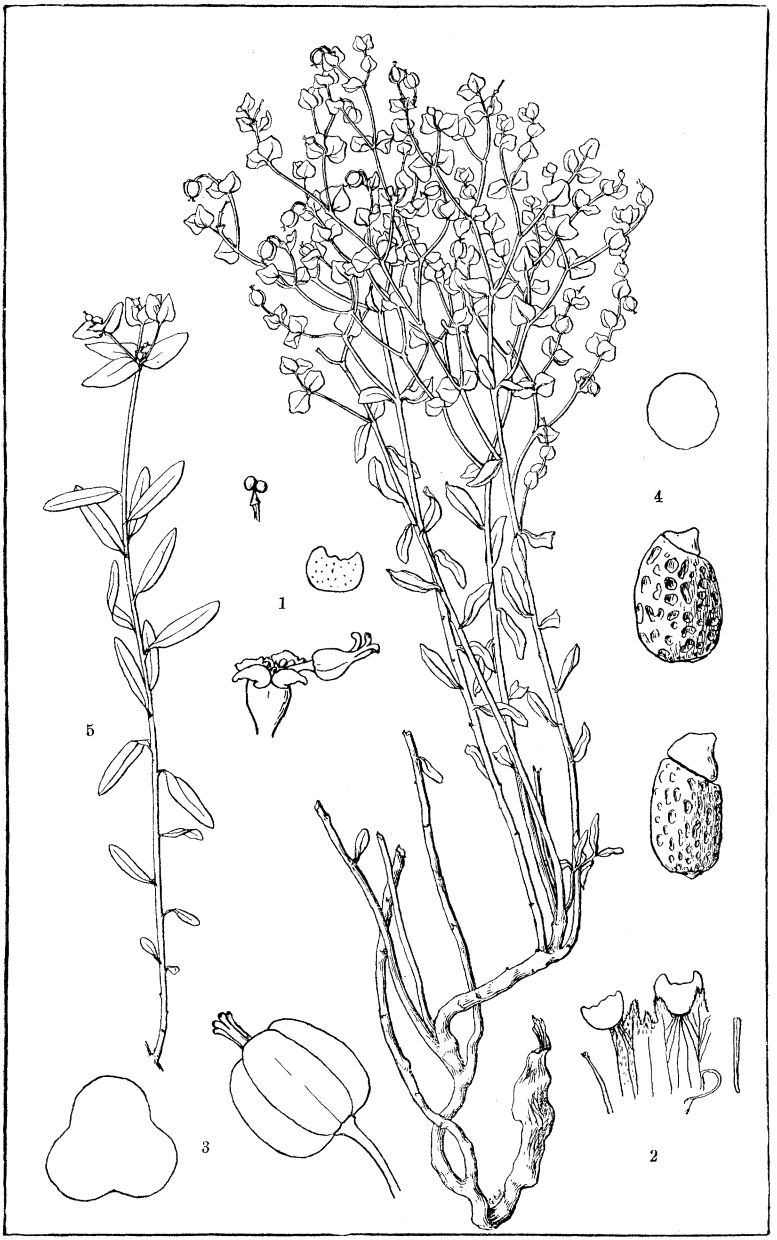

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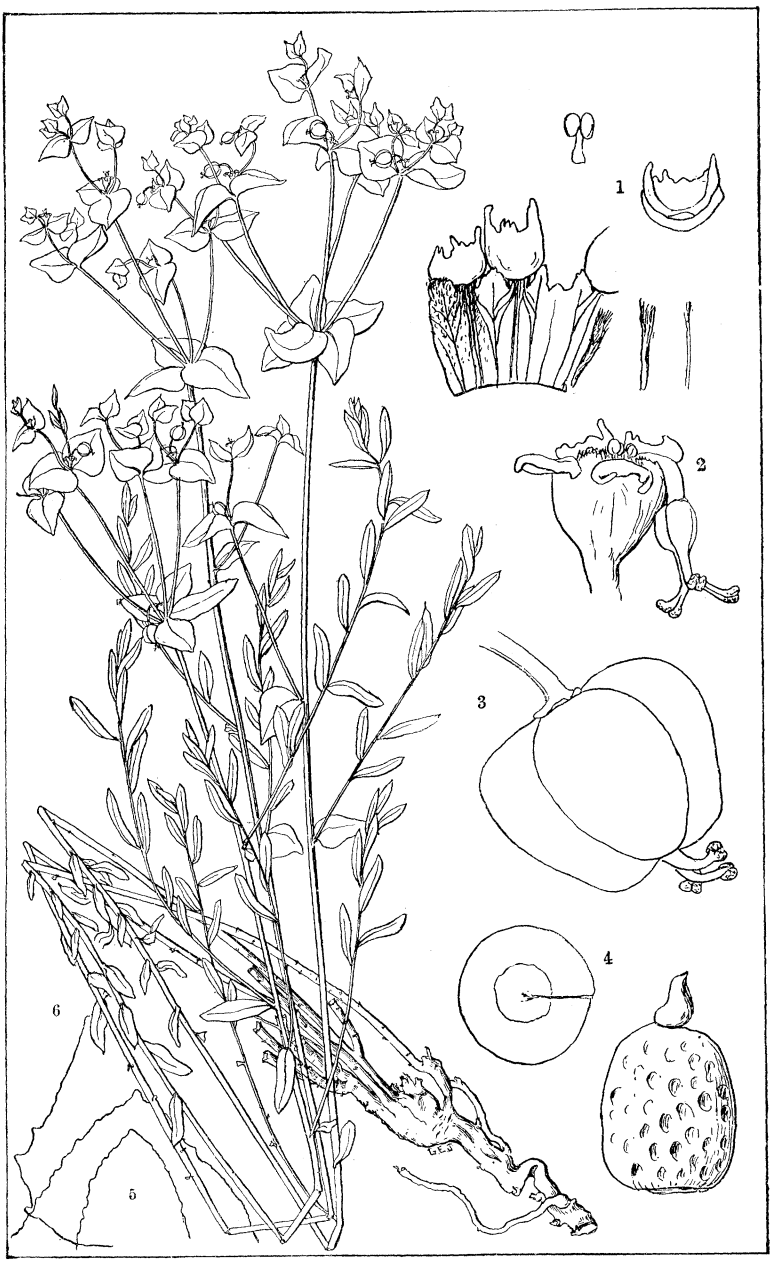

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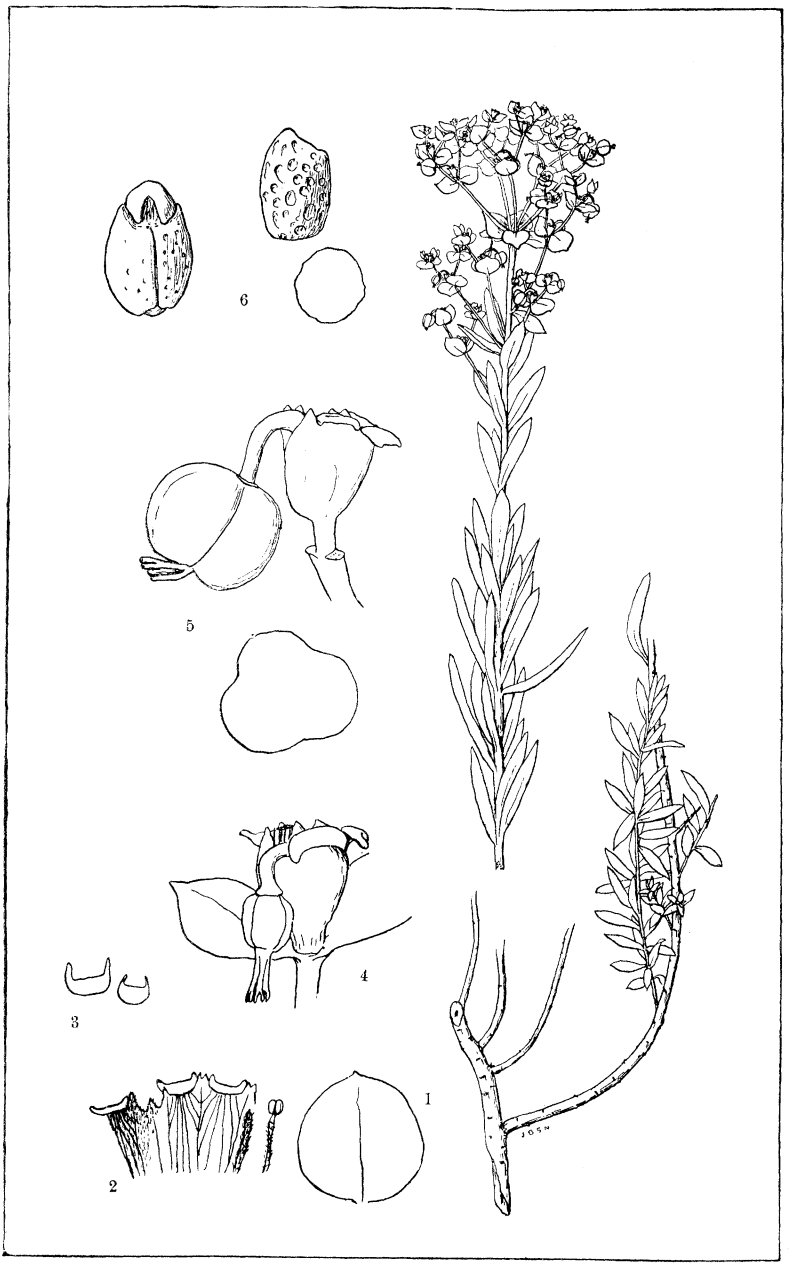

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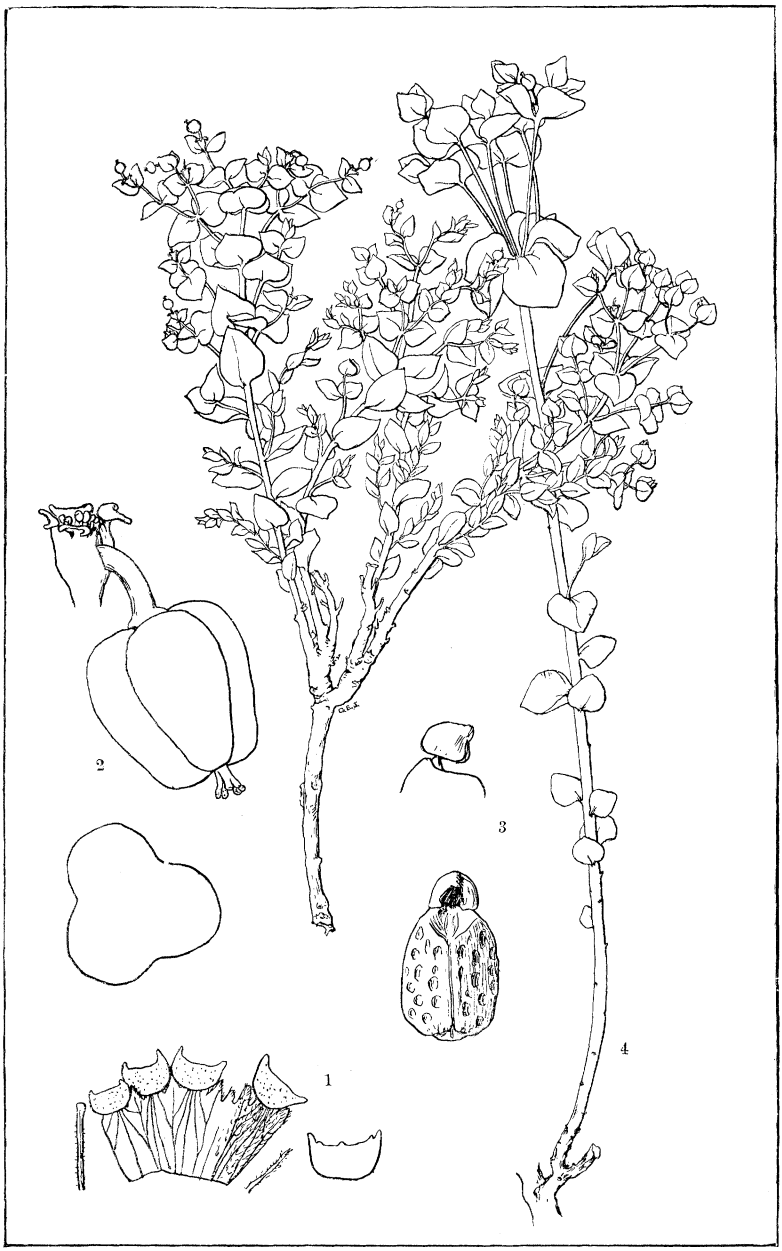

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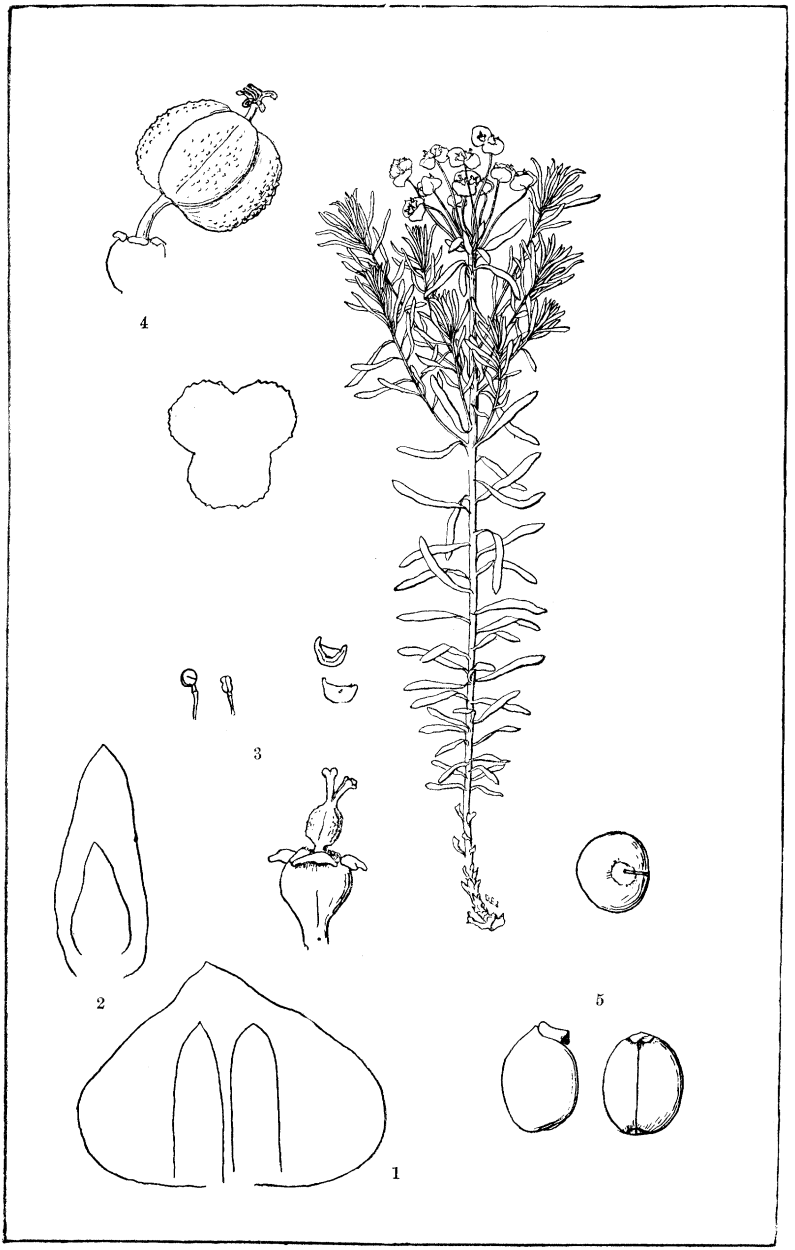

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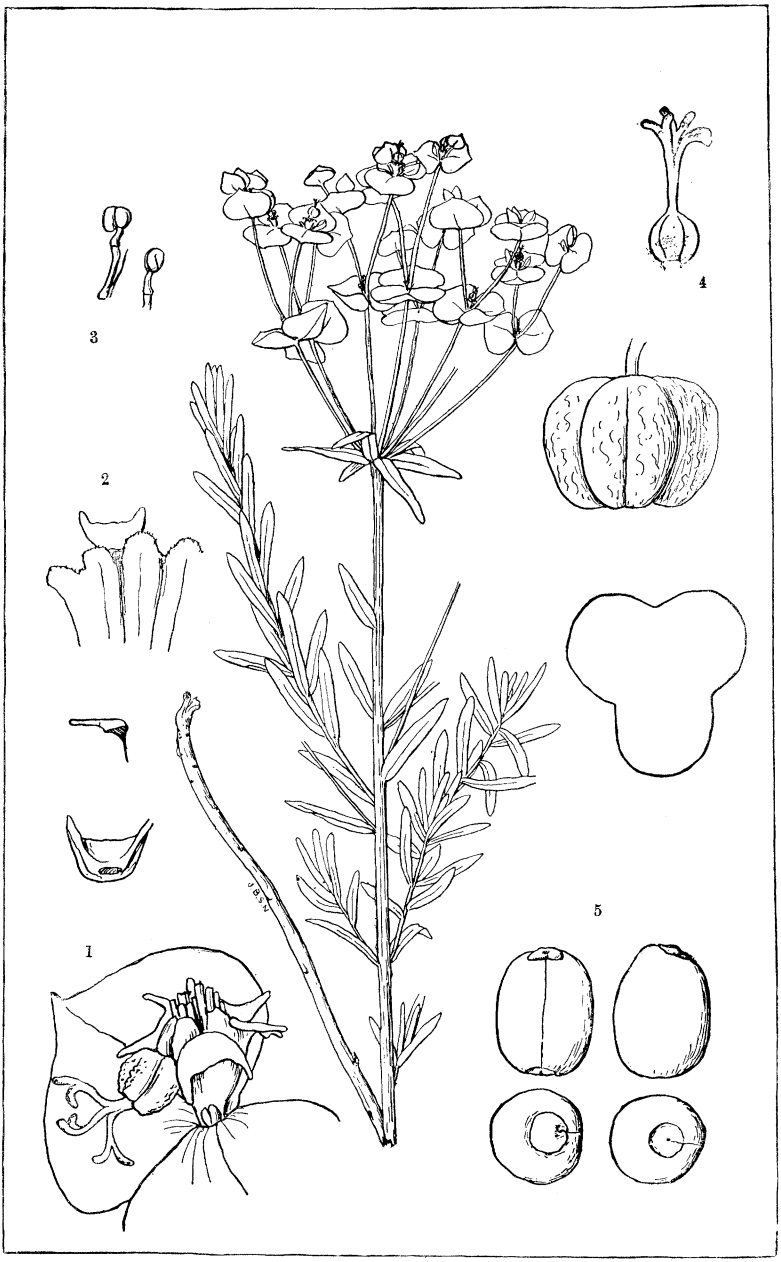

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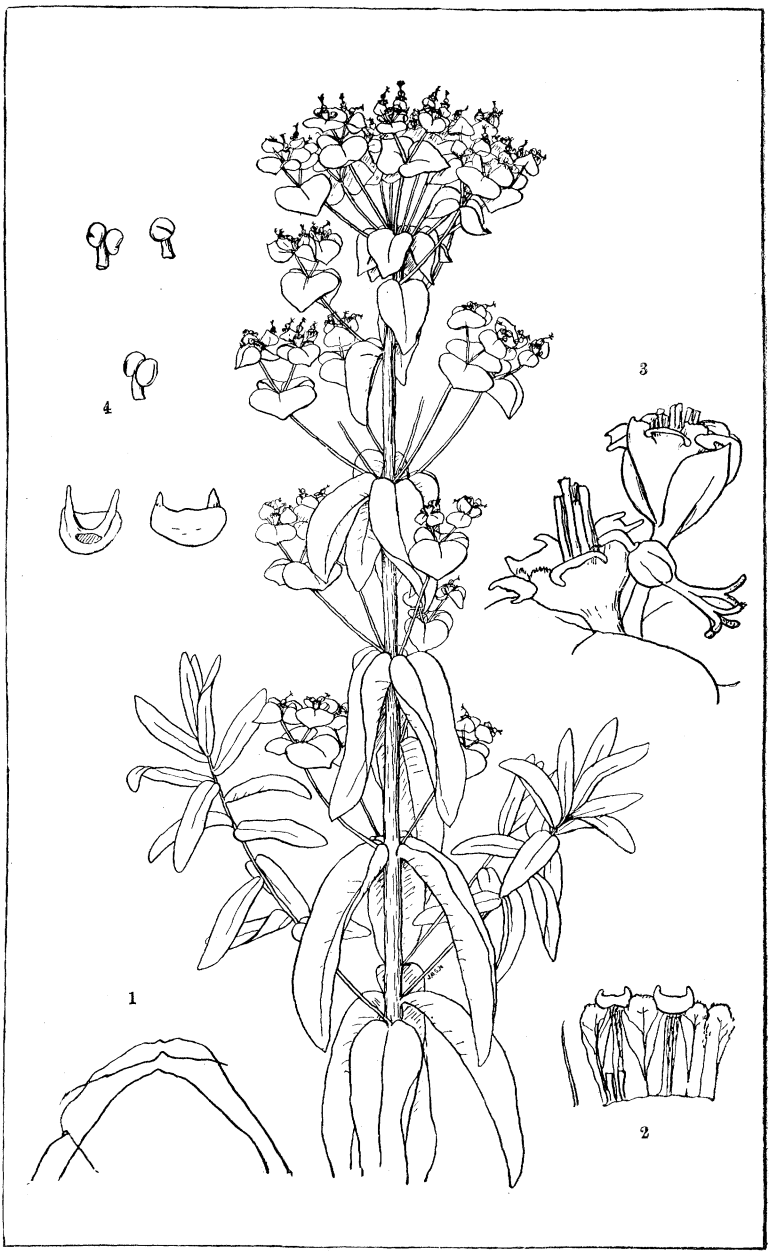

EUPHORBIA LUCIDA.